ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
OF POPULAR INFORMATION

SERIES 4 VOLUME VIII
1940

PUBLISHED BY THE
ARNOLD ARBORETUM
JAMAICA PLAIN, MASSACHUSETTS

ILLUSTRATIONS

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SERIES 4. VOL. VIII APRIL 26, 1940 NUMBER 1

THE GENESIS OF THE ARNOLD ARBORETUM

THE development of the Arnold Arboretum from the time of its establishment in Jamaica Plain has been described with thoroughness and understanding, especially by the late Charles Sprague Sargent, and more recently by Mrs. Susan D. McKelvey. From shortly after the date of its founding in 1872 until his death in 1927 it was continuously in the capable and creative hands of Professor Sargent, under whom it grew from scarcely more than an idea to an artistic, horticultural, and educational institution of first rank in the world.

The history of the institution is usually considered to have begun with the execution of an indenture between the President and Fellows of Harvard College and three trustees under the will of James Arnold of New Bedford. These three men were George B. Emerson, John J. Dixwell, and Francis E. Parker, all of Boston. To them, as trustees, had been bequeathed one and a quarter twenty-fourth parts of the residue of Mr. Arnold's estate, "to be by them applied for the promotion of Agricultural or Horticultural improvements, or other Philosophical, or Philanthropic purposes at their discretion . . .". The indenture contained agreements between the contracting parties: *first*, that the trustees would transfer the fund at their disposal to Harvard College, with the understanding that it be kept as a separate unit and allowed to accumulate until the principal had reached $150,000 and until the Bussey land in West Roxbury had finally become available to the College; *second*, that 5 percent of the net income each year should be added to the principal[1]; *third*, that the income should be used for the establishment of an arboretum to be known as the *Arnold Arboretum*,

[1]The James Arnold Fund now contains $174,793.17.

and to support the "Arnold Professorship" in the College; *fourth*, until the happening of the events named in the first clause, the college should be allowed to spend a third of the income in each year for preparations toward future development of the Arboretum; *fifth*, that the fund should be subject to the same minimal expense of administration as other College funds; and *sixth*, that the arboretum should be established upon a part of the Bussey estate in West Roxbury.

Mr. Arnold's will was drawn in January, 1867; and he died in December, 1868. The above indenture was signed on March 29th, 1872. Within this short space of time, therefore, the idea of starting an arboretum in the vicinity of Boston had crystallized; further, it was to be established as a part of the botanical organization of Harvard College, and was to be located at the newly-organized Bussey Institution in West Roxbury. The consequences of these arrangements have acquired such broad significance that it becomes of great interest to trace the stages by which they came about, to visualize the motives that determined them. The Arnold Arboretum was the first of its kind to be established in America, and has been the principal inspiration and source of ideas for the many institutions of similar aims now in existence. With whom did the idea of starting an arboretum originate, and how was it brought to the attention of the College? What were the causes for its establishment in West Roxbury rather than in Cambridge? There is nothing in the terse wording of the clause in Mr. Arnold's will to indicate that he had such a specific purpose in mind; in fact the latitude given the trustees was so great that they could have used the fund for a purpose entirely outside the field of botany. Professor Sargent states (10) that Mr. Emerson proposed that the Arnold bequest should be used for an Arboretum; and in two of the published accounts of Emerson's life (1, 13) there are brief notes to the effect that he was instrumental in securing the bequest.

A number of letters between the principal actors in the drama have recently been examined, and these throw new light on the questions just noted. The remainder of this sketch will be devoted to a brief account of their contents, together with such biographical items as seem pertinent.

James Arnold was born in 1781, at Providence, R.I., of Quaker parentage. Very little is known of his early life or education, but he came as a young man to New Bedford where he entered the business office of Mr. William Rotch, Jr. In 1807 he married Sarah Rotch, a daughter of William Rotch, and eventually became a partner in the Rotch mercantile concern. With increasing wealth he acquired an

estate of about eleven acres in New Bedford and built, in 1821, a mansion house of his own, surrounded by large lawns aud gardens. This establishment was a mecca for visitors through many years. The Arnolds both took a keen interest in the garden, building it in the varied but orderly manner of the English type. They carried on the unusual practice of opening it to the public on Sundays. Other than this natural interest in gardening, equaled if not superceded by that of his wife, we have no indication that James Arnold had any particular interest in natural history or horticulture. In fact, if he had any consuming interest outside his business, it appears to have been his study of classical literature. For this he was well-known among his neighbors, and was a prominent member of a local literary society of the day.

We do not know all the facts leading up to his bequest to the three trustees in Boston. It is clear, however, that he was influenced toward it by one of them, Mr. George B. Emerson, who was a relative by marriage, and apparently a rather close friend. Since Mr. Emerson played an important part in the succeeding events, some account of his life will no doubt prove significant.

George Barrell Emerson was born in 1797, at Wells, Maine, and died in Brookline in 1881. His father was a prominent physician in Wells, a graduate of Harvard in 1784. Young Emerson took his degree at Harvard in 1817, but suffered a severe illness during the latter part of his work there which considerably impeded his further studies. For two years after leaving Harvard he was master of a private school at Lancaster, Mass., and in 1819 was called to Harvard as a tutor in mathematics. In 1820 the English Classical School was founded in Boston, with Mr. Emerson as its first principal. He remained in this capacity until 1823, when he established a girls' school of his own in Boston. This proved to be a highly successful undertaking, and absorbed Mr. Emerson's active teaching energies for thirty years. In 1823 he married Olivia Buckminster, who died in 1832, leaving two sons and a daughter. A second marriage occurred in 1834, to Mrs. Mary (Rotch) Fleming.

He was prominent in the organization, in 1830, of the American Institute of Instruction; and a report on the school situation in Massachusetts, prepared by him and presented to the Governor of the Commonwealth, led to the organization of a State Board of Education with Horace Mann as its secretary. This step proved to be an important milestone in the development of public education, not only in Massachusetts but in the whole nation.

Although widely recognized in the field of education, he is also well known in the world of natural science for his classic work on the "Trees and Shrubs Growing Naturally in the Forests of Massachusetts." This book was prepared as a result of his appointment as chairman of a commission to make a zoological and botanical survey of the state. It went through five editions, the first of which was published in 1846. For six years, between 1837 and 1843, he was president of the then recently formed Boston Society of Natural History. In subsequent years Mr. Emerson travelled extensively in England, France, Italy and Germany, making observations of plant life and studies of educational methods. In 1870 he made a journey to the Pacific coast.

Here, then, was a man who by training, inclination and experience might have been a prime mover in the development of the arboretum idea. That he was is clear from the following letters. We have but little information concerning Mr. Dixwell or Mr. Parker. Professor Sargent says that the former was "a successful Boston business man, . . .also a lover and student of trees, and had assembled on his place in Jamaica Plain one of the largest and best collections of native and foreign trees which was growing at this time in New England"(12). A passage in one of Mr. Emerson's letters, quoted below, gives further indication of Dixwell's interest in matters botanical and horticultural. Mr. Parker was an attorney in Boston, and there is some evidence that he handled the financial transfers connected with the bequest.

In the Harvard College Archives is a letter from Professor Asa Gray to Dr. Andrew Preston Peabody who was Acting President of the College during a short period of months between the administrations of Thomas Hill and Charles W. Eliot. The letter is dated February 20, 1869 and was written from Egypt where Dr. and Mrs. Gray were travelling at the time. Dr. Gray says, "I am apprised in a letter from Mr. John Lee that Mr. Arnold of New Bedford, just deceased, has left a legacy of $100,000 to trustees for horticultural, agricultural, scientific or other like purposes, and that Messers Geo. B. Emerson, J.J. Dixwell, and F.B. Parker are the trustees. Whether any, or if any what sum is applied or applicable to horticulture and the like, I have not the means of knowing, nor whether the disposition is at the discretion of the trustees under the will. But I have reason to think that some provision may be made for arboriculture and an arboretum, and it is known to the Corporation of the University that I have, from time to time pressed the recommendation that the grounds around the Observatory, having the advantage of being contiguous to the Botanic

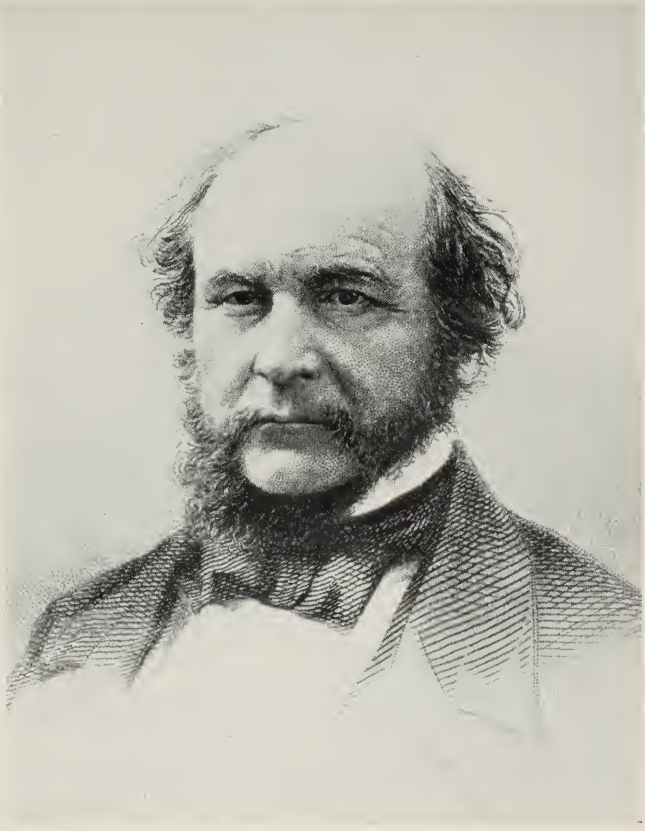

PLATE I

James Arnold

George B. Emerson

Garden, with some extensions (which could lately have been had without very great cost) should be utilized for the purpose of an arboretum, if ever the means for its support were to be had. Now, if any specific legacy has been made for such purposes, or one which may be so directed by Mr. Arnold's trustees, it would be well that the wants and desires of the University should be represented. And I dare say you may have already been in communication with the Trustees in regard to it. Two of them, Messers Emerson and Dixwell, are very well acquainted with our state and our wants at the Botanic Garden, and would no doubt give attentive consideration to any application of or in behalf of the University. Would you kindly let me know if there is anything to be expected."

This appears to have been the first time the Arnold bequest was brought to the attention of the College. The following note from Mr. Emerson to Dr. Peabody indicates that he had been approached as a result of Dr. Gray's letter. This note from Mr. Emerson is so illuminating that it will be quoted in full.

3 Pemberton Sq. Mar. 31. '69.

Rev. Dr. Peabody,

My dear friend, Dr. Gray is correctly informed in regard to several things about Mr. Arnold's will. He did leave to me, J.J. Dixwell and F.E. Parker, for purposes made known to Dr. Gray—a large bequest, probably two thirds of what it is reported to be. This was originally intended for an arboretum. But Mr. Arnold, to leave us at liberty, extended the limits of the bequest. We have hoped that an arboretum might be formed by it. But, if the greater part of the money would have to be expended for land at house-lot prices, I would be very unwilling to give it that direction. So far as I am concerned, I mean, if possible, to have an arboretum—and for Harvard College: and, if land can be found near the College, already in possession of the college or procurable at reasonable price, the arboretum will be more likely to be in Cambridge as an appendage to the Botanic Garden, than anywhere else. Indeed my original idea, in recommending such a bequest to my dear friend and brother, was the hope that the management of the whole garden by Dr. Gray might be facilitated by this bequest. Have the goodness to give my kindest regards to Dr. and Mrs. Gray, and tell him that now for the first time I feel jealous of you.

Ever sincerely yours,
Geo. B. Emerson

It thus becomes clear that Mr. Emerson, acting independently, and with a definite idea of an arboretum in mind, suggested to Mr. Arnold that he insert a favorable item in his will. The actual wording of the bequest was to give the trustees freedom in case it should not prove feasible to carry out the original idea. It is clear, further, that the original intention was that the arboretum should be a part of Harvard College; if possible, an adjunct to the then existing Botanic Garden under the capable direction of Dr. Asa Gray. In his letter to Dr. Peabody, however, Mr. Emerson was already doubtful as to whether the last would be possible, since he did not approve of diverting any large part of the money to "capital investments" in land. It is of interest to note, in passing, that his reasoning is still good in many aspects of the financing of biological education and research. The fact that such institutions as Harvard University already have large investments in lands, equipment and personnel is of first importance to donors who wish to see their gifts used largely for actual teaching or investigations rather than for expensive material developments.

It is difficult to determine how much influence was exerted by Dr. Gray in formulating the project. He says, in the letter quoted above, that Emerson and Dixwell were both familiar with the problems of the Botanic Garden in Cambridge, and it is not impossible that they had discussed the development of an arboretum. It seems clear, however, both from Gray's and Emerson's letters, that the idea had not taken definite form.

With the purpose established, and the means available, it was finally decided that the arboretum should be at the Bussey Institution, on land already owned by the College. Who made this decision is not definitely known. In the minutes for the meeting of the Harvard Corporation of March 18th, 1872, it is stated that President Eliot "read a memorandum of a proposed contract between George B. Emerson, John J. Dixwell and Francis E. Parker. . . .whereupon it was voted that the President be authorized to sign a contract in conformity with the terms of the memorandum. . . ." A marginal note describes this as the "Memorandum of a proposed contract for an Arboretum at the Bussey Inst'n."

The memorandum itself has not been found, although it may have been only an original draft of the later indenture. Sometime between March, 1869, and March, 1872, the whole matter must have been threshed out. By June, 1872, the indenture had been ratified by both parties and signed. Three letters during this short period are worthy of note. The first is from Dr. Gray to President Eliot, undated

but presumably in the first half of 1870. In it is the following paragraph: "Mr. Longfellow met me yesterday with a plan in his head that you ought to know about. He proposes to be one of 12 or more to buy a large bit of Brighton Meadows for $12,000 and present it to the College—[I suppose land directly opposite his house!] I told him that if the land he proposed to acquire would serve for an arboretum, I thought the likelihood of his finding partners in the purchase would be largely increased. After inquiring what an *arboretum* might be and why I thought so, he said he would go and see Mr. Emerson." The land along the Charles River, some 70 acres, was purchased and presented. Mr. Longfellow's letter of transmittal was dated July 4, 1870, but it contains no mention of the possible use of the property for an arboretum.

It is probable that the plan for using the Bussey land was already underway at this time. A letter from Mr. Emerson to President Eliot dated December 8, 1869 (Mr. Eliot had been elected President in May of that year) begins with the following sentences: "It would be of little use for us to go to Roxbury while the snow would prevent our walking freely about the Bussey fields and woods. But I would like to talk with you about the intentions of the President and Corporation as to an agricultural school to be established upon that estate." The remainder of the letter contains an outline of what Emerson considered should be the aims and methods in the proposed school of agriculture. We may infer from this letter that Mr. Emerson had been approached by President Eliot as early as 1869 with the proposal that they examine the Bussey land together, presumably with the idea of placing the Arboretum there.

By way of summary, it may be said that a large portion, if not most, of the credit for the starting of an arboretum at Harvard is due to Mr. George B. Emerson. The idea appears to have first taken form in his mind, and he secured an initial endowment fund sufficiently large to make a concrete beginning of the project. Further, together with his fellow trustees of the Arnold bequest, John J. Dixwell and Francis E. Parker, he formulated an unusually far-sighted arrangement with the College for the future handling of the money. Also, we cannot underestimate the significance of Dr. Asa Gray's influence, not only upon Mr. Emerson himself, but in first bringing the whole matter to the attention of the College. That Dr. Gray continued his interest in the Arboretum, and later influenced the actual planning of the grounds, is indicated by an item found in an account of the life of Frederick Law Olmsted, the great landscape architect who had

so prominent a part not only in the development of the Arboretum, but also of the entire Boston park system. This note states that Olmsted spent the summer of 1878 "with E. L. Godkin in Cambridge in order to work out plans for Arboretum with Professor Gray and Sargent." (8) The first topographic map of the grounds, with proposed driveways, was made at about the same time. It is probable that to Dr. Gray must also be given the credit for the extraordinarily wise appointment of Charles Sprague Sargent as the new Arnold Professor of Aboriculture and head of the youthful Arboretum. There are several references to Sargent in Gray's published letters, especially to his friends in Europe, all of them in terms of highest praise. Professor Sargent was for several years in charge of the Botanic Garden in Cambridge, and closely associated with Dr. Gray.

It is difficult to conceive of a finer memorial to an individual than that of the Arnold Arboretum to James Arnold. He did not deliberately plan it so during his own lifetime, but entrusted it to a group of friends whose judgment he respected. The peculiarly fortunate combination of events and ideas described above has probably given perpetuity to his name far more effectively than would have been possible had a specific program been laid down by Mr. Arnold himself.

ACKNOWLEDGEMENTS

The writer is indebted particularly to the keeper of the Archives of Harvard University for permission to search the files of correspondence and records for notes on the Arboretum's early history. He wishes to express his appreciation also to Mr. Jerome D. Greene, Secretary to the Corporation, for granting permission to publish parts of the correspondence. Miss Lucy Lowell of Boston, a granddaughter of Mr. Emerson, has very graciously placed at the writer's disposal her personal recollections of the man himself and of his connection the beginnings of the Arboretum. The portrait of Mr. Arnold is from Ellis' *History of New Bedford*, while that of Mr. Emerson is taken from Waterston's *Memoir*.

REFERENCES

1. Anon. *George B. Emerson.* Proc. Am. Acad. **16:** 427-29 (1881). (This note has been attributed to Professor Asa Gray, but his name does not appear as the author of it, nor is it in the volume of his collected necrologies).

2. Bouvé, Thomas T. Note on Geo. B. Emerson in a *Historical Sketch of the Boston Society of Natural History*, etc. Anniversary Mem., Bost. Soc. Nat. Hist. 1880, pp. 235-37.

3. Ellis, L.B. *History of New Bedford and its Vicinity, 1602-1892.* D.Mason & Co. (1892).

4. Jenkins, Edw. H. *George Barrell Emerson.* Dict. Am. Biography **6:** 127-8 (1931).

5. McKelvey, Susan Delano. *The Arnold Arboretum.* Harv. Alumni Bulletin **38:** 464-72 (1936).

6. Morison, J.H. *George Barrell Emerson.* Unitarian Rev. **16:** 59-69 (1881).

7. Morison, Samuel Eliot. *The Development of Harvard University Since the Inauguration of President Eliot, 1869-1929.* Harv. Univ. Press (1930).

8. Olmsted, F.L. Jr., and Theodora Kimball. *Frederick Law Olmsted, Landscape Architect, 1822-1903; Early Years and Experiences.* Putnam's, New York (1922).

9. Pease, Z.W. *The Arnold Mansion and its Traditions.* Old Dartmouth Historical Sketches No. 52 (1924) New Bedford.

10. Potter, W.J. *To the Memory of James Arnold,* New Bedford (1868).

11. Ricketson, Daniel. *New Bedford of the Past.* Houghton-Mifflin (1903).

12. Sargent, Charles Sprague. *The First Fifty Years of the Arnold Arboretum.* Jour. Arn. Arb. **3:** 127-171 (1922).

13. Waterston, Robert C. *Memoir of George Barrell Emerson, LL.D.* Proc. Mass. Hist. Soc. **20:** (1882-3).

Hugh M. Raup

ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
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SERIES 4. VOL. VIII MAY 3, 1940 NUMBER 2

THIS PAST WINTER

THIS past winter has been very hard on many of the evergreens not only in the Arboretum but also in many of the Boston suburbs. Particularly injured have been the rhododendrons, Canada hemlocks, and arborvitaes. It is difficult to cite the exact time when injury occurred, but it is doubtful whether any of it took place much before March 1. This is certainly the case with the hemlocks. Many of the native Canada hemlocks have been under observation, the trees apparently remaining in good condition throughout the winter, with green foliage and no apparent injury whatsoever even as late as the end of February.

However, during early March there were a few warm, sunny days. Since the ground was still frozen, transpiration from the foliage was at a maximum, and because of frozen soil, the plant roots were unable to take in sufficient water to make up for the loss from the foliage. The warm sunny days were followed by a period with low temperatures and high, cold winds. As a result, evergreens in exposed situations were badly burned, and in many cases have become unsightly.

One particular instance proved interesting. On the grounds of the Adams House, adjacent to the Arboretum, there is a planting of large Canada hemlocks. As would be expected, these were very badly burned on the southwest side. Standing in the same location, with exactly the same amount of exposure, was a fifteen year old Carolina hemlock. This tree showed no burning whatsoever. No general conclusions should be drawn from this, since Carolina hemlocks in other situations around Boston were injured also, but apparently in this particular soil with this particular exposure, the Carolina hemlock was more resistant to injury.

The rhododendron collection suffered considerably because of foliage injury, especially those plants immediately opposite the road junction. This is the windiest spot in the collection; and, though these plants were protected with evergreen boughs, as they are every year, the covering was not sufficient to protect the foliage completely. Some plants have lost a number of leaves and it may be necessary to prune these individuals later.

Other plants that have suffered are the green-twigged brooms on Bussey Hill. Some of the *Cytisus scoparius* varieties had grown to be about six feet tall, but were so badly injured that they will have to be cut back materially. The interesting hybrid Warminster broom (*C.praecox*), which has been recommended in other issues of the Bulletin, came through with no serious harm, showing that it is well adapted for New England planting.

Some years the oriental flowering cherries on Bussey Hill have suffered materially from sun-scald. However, though it is a little too early to tell definitely, there was apparently no injury to the trunks this past winter.

The winter has not been so unusually cold as far as low temperatures are concerned. According to the official figures of the Weather Bureau, the temperature went below 10° (above zero) only four times during the winter, one day in December and three days in January. Even then the minimum was 6° (above). Consequently, none of the injury can be blamed entirely on low temperatures even though these temperatures listed by the Weather Bureau are higher than those for the surrounding suburbs. As a result, we anticipate little, if any, injury to deciduous plant material.

This Spring

Officially spring began on March 20, but a few days later an unusually cold spell descended on the northeast. Four days after spring officially started the temperature went down to 14° (above) making this day an inauspicious one for spring flowers. At the time this is being written, woody plants are blooming almost two weeks late. Earlier this season, azaleas were blooming in northern Florida about four weeks late. Farther north, in Washington, D.C., the Japanese cherries were in full bloom in a snow storm, blooming as late as they have at any time during the past six years. In Philadelphia, forsythia was just beginning to show a yellow color on April 20; while in the Arnold Arboretum, it has not even started by April 27—at least two weeks later than it normally blooms.

PLATE II

Flowering branch of *Cornus mas*, one of the earliest shrubs to bloom in the spring.

It is difficult to say just how the blooming dates of later flowering shrubs will be affected, but undoubtedly they will all be retarded for a period. An examination of the Bulletin of Popular Information of Nov. 29, 1939 (Vol. VII, No. 11) will show the approximate blooming dates of many ornamental flowering shrubs. Interesting comparisons can be made with this list and with blooming dates for 1940. Another interesting comparison is afforded by carefully observing the table on the last page of the Bulletin for April 29, 1939 (Vol. VII, No. 3). It will be noted that last year blooming dates were later than they had been since 1931, when these particular records were first started. This year (1940) is even later. On the date this is written (April 27), *Daphne mezereum*, *Cornus mas*, *Forsythia ovata*, and *Magnolia stellata* are not in full bloom. Each of these plants shows considerable color, but the flower buds are not fully open. Though one very warm day would hasten results, the cold temperatures and overcast skys of the past week have not been conductive to bringing these plants into full bloom immediately.

The perennial question of, "When will the lilacs bloom?" is as yet unanswerable. Probably, Memorial Day would be a conserative guess, but this year, as last, we will have to wait a week or two before being able to give a dependable reply.

Donald Wyman

Notes

Dr. E. D. Merrill, Director of the Arnold Arboretum, has recently been elected an Associate Member of the Muséumd'Histoire Naturelle, Paris, in appreciation of his services to that institution.

On the evening of March 13, the Horticultural Club of Boston honored Professor Alfred Rehder, Curator of the Herbarium of the Arnold Arboretum, with a testimonial dinner at the Parker House. This was in appreciation of his 42 years of service at the Arnold Arboretum and for his outstanding contributions to the literature of botany and horticulture.

Subscription renewals for 1940 are now due. Those who have not resubscribed, and who desire to continue to receive the Bulletin, should remit $1.00 to the Bulletin of Popular Information, Arnold Arboretum, Jamaica Plain, Massachusetts, at an early date to insure continuity in the receipt of the numbers as issued.

ARNOLD ARBORETUM
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SERIES 4. VOL. VIII MAY 10, 1940 NUMBER 3

SOME TRIALS AND TRIBULATIONS OF AN ARBORETUM

ONE of the many services conducted by the Arnold Arboretum is that of distributing material for propagation, (seeds, cuttings, or living specimens) of new and rare plants to individuals who ask for them explicitly. This includes some species of no particular ornamental value, since other institutions frequently desire specimens of these for scientific study. Naturally, requests for material representing ornamental species far outnumber those for species and varieties of merely scientific interest.

Throughout its history the Arnold Arboretum has sent out thousands of packets of seeds, cuttings, scions, and plants, mostly representing rare or otherwise desirable material. The following figures represent the distribution from 1922 to 1938.

Seed packets	43,000
Living plants	38,167
Lots of cuttings and grafts	11,200

Distribution to Various Parts of the World

To the United States	87%
To Europe	10%
Elsewhere	3%

These figures clearly indicate the practical services of the Arnold Arboretum to the horticultural public. Certain plants of outstanding merit are described in the Arboretum publications and in papers written by Arboretum staff members, and published elsewhere. Some species or varieties are quickly accepted, perhaps because of their appeal to popular fancy. Others, just as valuable from an ornamental stand-

point, are very slow in finding their way into nursery catalogues. Such listing is necessarily the first step in order that these plants may eventually reach the wider gardening public. There are at least two reasons why nurserymen do not propagate all new plants immediately. In the first place, it is relatively expensive to establish a large stock and to advertise a new plant, for, of course, professional nurserymen must be interested in financial returns. Secondly, many nurserymen are already overstocked in more or less standard species and varieties and thus naturally hesitate to propagate forms that are new and hence unknown to the horticultural public.

We hear frequent criticism to the general effect that new woody plants are not available since nothing new is listed in current catalogues. As a matter of fact, there are hundreds of relatively rare plants not only in the numerous arboreta in America but also in private gardens, which are perhaps better suited for landscape planting than others which have been generally available for many years. Some of our experiences at the Arnold Arboretum in attempts to popularize outstanding species and varieties may be of interest.

Acer saccharum monumentale: This tree is a striking example of the trials and tribulations that beset an arboretum. One plant was found in a cemetery in Newton, Massachusetts, and scions were taken January 21, 1885. As a result of this propagating our plant has since been growing in the Arboretum for over fifty years only a hundred and fifty feet from the Arborway, one of the very busy parkways serving Boston. Approximately 11,000 cars pass in sight of this tree from 7 a.m. until 6 p.m. on an average day in winter and, of course, this number is considerably greater during the spring and summer. Its picture has appeared in the Bulletin of Popular Information (Plate XII, 1938, p. 65), it has been illustrated in newspapers and gardening magazines throughout the east, and as a result it has undoubtedly been seen by at least a million readers during the past fifteen years. It has been discussed before garden clubs and nursery organizations throughout the east and middle west. On several occasions during the last fifteen years, it has been carefully described in nationally circularized garden magazines.

This tree is always pointed out to Arboretum visitors as outstanding among the many unusual ones grown at the institution. It has all the meritorious characteristics of the sugar maple, differing only in its columnar habit. It has the growth form of the Lombardy poplar without the objectionable characters of that widely known and commonly planted columnar tree. Many people photograph it, write us about it,

and inquire where it may be purchased. Yet, it is offered in no nursery catalogue.

What has the Arboretum done to disseminate it? Our propagator, Mr. Judd, has kept detailed records about this plant since 1922. Approximately 4000 scions have been cut and distributed from this one tree, and 22 living plants have been sent to various organizations interested in the propagation of rare or unusual varieties. In spite of all this, still the tree is not available to the general public. During the last three years there have been so many requests for propagating stock that it is now practically impossible to select suitable material, even with the aid of a tall ladder and pole shears. One nurseryman obtained grafting material five different times between 1927 and 1933; yet he has never listed it in his catalogue.

Euonymus planipes: This shrub was introduced into the United States by the Arnold Arboretum in 1902. Realizing its value as an ornamental, the Arboretum, between 1920 and 1938, has distributed 12 lots of cuttings, 63 plants, and 49 packets of seeds. It was not, however, until 1938 that it was first listed in an American nursery catalogue by a leading Massachusetts nurseryman. It apparently takes a considerable amount of "distributing" before a new plant is deemed by the grower to be worthwhile.

Syringa pubescens: Commonly called the hairy lilac, this is the most fragrant of all the lilacs and for this reason alone is a valued addition to lilac collections, even though the flowers are not as beautiful as the varieties of *S. vulgaris*. Between the years 1922 and 1940, no less than 157 plants and 63 lots of cuttings have been sent to various individuals and nurseries. Although it has been offered in one or two catalogues for a short period only, it was soon dropped either because there is no apparent demand for it or because it is too difficult to propagate rapidly.

Viburnum dilatatum xanthocarpum: This was obtained by the Arboretum as a small plant in 1919. Approximately 30 nurseries in the United States have obtained propagating material in one form or another since then, but it has yet to be listed in a catalogue. Another form (*Viburnum setigerum aurantiacum*) of particular value for its orange fruits, has been growing in the Arboretum since 1908. Between 1931 and 1939, plants have gone out to 89 different individuals, seeds to 40 others, and cuttings to many more; still the plant is not listed in any catalogue.

Of course, woody plants cannot be propagated as rapidly as perennials and annuals. Combined with this is perhaps a lack of interest

on the part of nurserymen and gardeners—two facts which make it exceedingly difficult to place new woody plants within the reach of the public. Do not blame the Arboretum! The plants are here, they are being propagated, and they are being discussed. It is for the garden-minded public to study these interesting plants and to begin to ask for them. Only then will they be grown, for nurserymen are naturally interested in plants for which there is a demand.

It is manifest that the garden-minded public is becoming increasingly plant conscious. The garden clubs are doing excellent work in educating their members to consider better plant materials. There is even a movement among some of the nurserymen to be more selective in growing only the better varieties and in discarding inferior forms. Such a movement, if aggressively carried on by both garden clubs and the nurseries, should aid materially in bringing the better plants into more common use.

MERITORIOUS ORNAMENTAL PLANTS

Plants and material for propagation of which have been sent out by the Arnold Arboretum since 1922

Name	First offered in Nursery Catalogue
Acer griseum	Not yet
Acer rubrum columnare	Not yet
Acer saccharum monumentale	Not yet
Albizzia julibrissin rosea (hardy strain)	1936
Cedrus libani (hardy strain)	Not yet
Enkianthus cernuus rubens	Not yet
Euonymus planipes	1937
Halesia monticola rosea	Not yet
Laburnum alpinum	1939
Ligustrum vulgare pyramidale	1937 (1 yr. only)
Magnolia stellata rosea	1937
Prinsepia sinensis	1925 (1 yr. only)
Prinsepia uniflora	Not yet
Sophora japonica pendula	Not yet
Stewartia koreana	Not yet
Syringa persica laciniata	1937
Syringa pubescens	1937
Viburnum dilatatum xanthocarpum	Not yet
Viburnum sargenti flavum	Not yet
Viburnum setigerum aurantiacum	Not yet

Donald Wyman

ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. VIII MAY 17, 1940 NUMBER 4

MAP OF THE ARBORETUM

IN this number of the Bulletin, as an insert, is included a copy of the new map of the Arnold Arboretum. The methods used in making this map were fully explained by Dr. Croizat in the Bulletin of May 16, 1938 (Series 4. Vol. VI No. 5). This map is complete and as nearly accurate as many months of careful work can make it. To the average visitor, it is complete as it appears on the insert; but to those who know the Arboretum and are accustomed to looking up individual plants within its 265 acres, the map represents only a very small part of our very extensive mapping program,which is now rapidly reaching completion.

The grounds are arbitrarily divided into 74 equal sections, and individual maps have been made for each, each map being divided into quadrants. The location of every tree and shrub growing in the planted collections of the Arboretum is registered. These maps are permanent records but would not be useful to the average visitor if it were not for a complete card index on which are listed the numbers and map quadrants for each individual plant. With this as an aid, it is possible then to go to the card index, find the name of the plant in question, get the corresponding map number and quadrant number from the card, and thus find immediately the location of the plant on its particular map. Such a system is most useful, not only to Arboretum staff members but also to many visitors who come for the sole purpose of studying individual plants, to check their characteristics or growth habits, or to see them in flower.

Two staff members have been trained in the making of these maps, and it is their duty to keep them up to date. This in itself is not as easy as it might appear to be. Each year from 400 to 500 new plants are distributed throughout the collections. Some die and accurate information must be kept concerning these. With others, name changes may have been made, or certain individuals may have been re-identified. Therefore, it takes much time and careful work to keep all this information completely up to date.

Mapping is the only method by means of which a very large collection of living

plants such as are found in the Arboretum, can be kept properly labeled, there being approximately 7000 named species and varieties in the collections. Labels disappear, either because of age or sometimes because of vandalism. However, if collections are mapped properly, plants with missing labels can be immediately identified by reference to the map; and, because the registration number of each plant also appears on the map, not only the name of the plant but also its complete record can be located immediately, even though the label is lost. Consequently, this mapping program, which is now practically completed, is a great boon to the Arboretum and is the means by which accurate labeling will be coordinated with permanent records in the future.

Early Magnolias: All of the early flowering magnolias were in splendid condition at the Arboretum last week. Most of these have white flowers, and, though the flower buds of *Magnolia stellata rosea* are pink, the flowers themselves eventually fade white. Of course, *M. soulangeana* and its several varieties are not considered in this group since they bloom after the early flowering white species and varieties.

A new hybrid, *M. proctoriana* has recently been named by Professor Rehder. Occurring in 1928 in a batch of seedlings grown from seed collected on the Proctor estate at Topsfield, Massachusetts, it is a cross between *M. salicifolia* and *M. stellata*. It differs from *M. salicifolia* in the number of petals being 6–12 instead of 6 as in *M. salicifolia* and in the pubescent leafbuds while those of *M. salicifolia* are glabrous; it differs from *M. stellata* in that the number of petals in the flower are 6–12 rather than 12–18 as is the case with *M. stellata*. Also, it is apparently growing to be an upright tree, vigorous of growth, and not slow-growing and mound-like as *M. stellata*.

The following notes on the white flowering magnolias appearing in early spring may be of assistance as identification aids.

MAGNOLIAS WITH EARLY WHITE FLOWERS

Name	No. of Petals	Diameter of Flowers	Shape of Petals
M.denudata	9	$4\frac{1}{2}''$–$6''$	Oblong-obovate
M.kobus	6	$4''$	Oblong-obovate
M. kobus borealis	6	$4\frac{3}{4}''$	Oblong-obovate
M.proctoriana	6–12	$4\frac{1}{2}''$	Narrowly oblong-obovate
M.salicifolia	6	$4\frac{3}{4}''$	Narrowly oblong-obovate
M.stellata	12–18	$3''$	Narrow-oblong

The **shadblows** also have been unusually beautiful during the past week. Much has been written in other issues of the Bulletin concerning the beauty of *Amelanchier grandiflora*, a large flowering hybrid between *A.laevis* and *A.canadensis*. Its "pink" flowering variety, *rubescens*, has also been discussed. However, *A.*

PLATE III

Showing the differences in the flowers of three early magnolias.
From left to right: *Magnolia kobus borealis*, *M. kobus*, *M. stellata*.

grandiflora rubescens, as it is now growing in the Arboretum, does not show any horticulturally outstanding characters that would warrant its being grown instead of the species. It is true that the flower buds are slightly pinkish, though at a distance of a few feet this color is practically unnoticeable and as the flowers open they fade to white. Consequently, the "pink" flowering *A. grandiflora rubescens* is relatively unimportant after all, and need not be substituted for the species in landscape work.

This week the **Japanese flowering quinces** are in full bloom. Over 30 species and varieties are planted in the shrub collection where they can easily be observed and studied.

The **bush honeysuckles** are also coming into bloom, the greater number of which are located in the shrub collection and across the road from the lilacs.

The **largest displays of the week** are the azaleas on Bussey Hill and the oriental flowering crabapples. *Rhododendron schlippenbachi*, the royal azalea, came into full bloom about the first of the week, but *R. yedoense* and its variety *poukhanense* should be in full bloom by the time this Bulletin reaches its readers. *Rhododendron obtusum kaempferi* has been showing a little color on its flower buds, and during the week of May 19 it should be in full bloom. Hundreds of these excellent shrubs have been planted in the woods in various parts of the Arboretum, the planting having been done years ago under the direction of Professor Charles S. Sargent and Mr. E. H. Wilson, both of whom were justly fond of this gorgeous, fiery red azalea.

NEW PLANTS FROM ABROAD

Despite the European war, over 200 living plants have been received from Europe during the past few weeks. None of the species and varieties are in the Arboretum collections, many of those in these shipments being first introductions into the United States. Over 100 distinct species and varieties are represented. In spite of the fact that they were about six weeks in transit, all arrived in good condition and are now growing in the nursery.

From the other side of the world, where another war is being waged, comes an important shipment of seeds. This lot, containing about 150 packets, comes from the Lu-Shan Arboretum, Likiang, China, the seed having been collected in 1939 at higher altitudes in northwestern Yunnan Province. The package was actually shipped about six months ago. This accession came as the result of a small grant made by the Arboretum last year to support cooperative horticultural-botanical field work in China. More recently the corresponding botanical material has been received in the form of twenty-three large parcel post packages.

With wars being waged on opposite sides of the globe, it is interesting to note that the Arboretum is continuing to import seeds and living plants from both war-torn areas.

Donald Wyman

ARNOLD ARBORETUM

HARVARD UNIVERSITY

JAMAICA PLAIN, MASS.

Scale 0 50 100 200 400 600

CENTRE ST.

To Providence R.I.

← U.S. Route No. 1 To New York

CENTRE ST.

← Providence R.I.

Boston

Jamaica Plain

Director's House

Monastery of St. Clare

Nervine Hospital

Administration Building

Tulip-trees

Magnolias

JAMAICA PLAIN GATE

Currants

Shad-bushes

Willows

Lindens

Horse-chestnuts

Hackberries

Birches

Elms

Lilacs

Locusts

Maples

Japanese Maples

Sumacs

Shad-bushes

Catalpas

Ashes

Mock-oranges

Shrub Collection

Japanese Cherries

FOREST HILLS GATE

Mass. Routes No. 3, 28, + 138 To Cape Cod

To Forest Hills Station

BUSSEY BROOK PARKWAY

SOUTH STREET

State Laboratory

Crab-apples

Pears

Green-houses

Japanese Dwarf Trees

Wisterias

Experimental Plot

Bussey Institute

Hedges

Experimental Plot

CENTRE ST. GATE

Rare Plants

Weigelas

Viburnums

Hickaries

Spireas

Walnuts

Euonymus

Hickaries

Mountain Ashes

Oaks

Barberries

Cherries

Rockery

Barberries

BUSSEY HILL

Oaks

Azaleas

Asiatic Plants

Cedars of Lebanon

Azaleas

Asiatic Oaks

Sanitary

Beeches

Torch Azaleas

Laurels

Rhododendrons

SOUTH ST. GATE

Laurels

Bussey Brook

Junipers

Arbor-vitaes

Yews

Horn-beams

Canifers

Dwarf Canifers

Hazels

Canifers

Larches

Yews

Bussey Brook

Larches

Canifers

Crab-apples

Hawthorns

Miscellaneous Trees

PETERS' HILL

Hawthorns

Crab-apples

Pears

Crab-apples

HEMLOCK HILL

Laurels

Bussey Brook

HEMLOCK HILL

Laurels

BUSSEY STREET

WALTER ST. GATE

Nursery

Walter St. Tract

Joyce Kilmer Park (City of Boston)

WALTER ST.

WELD ST.

ROSLINDALE GATE

BUSSEY ST. GATE

Miscellaneous Trees

Hawthorns

Paplars

Paplars

Paplars

Paplars

SOUTH STREET

DEDHAM BRANCH OF N.Y., N.H., + HART. R.R.

ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. VIII MAY 24, 1940 NUMBER 5

THE ARBORETUM LILACS IN THEIR ORDER OF BLOOM

THERE are at least five full weeks of lilac blooms at the Arnold Arboretum. This is not known to every Arboretum visitor, since to the majority, lilacs bloom only during a ten-day period in late May. It is true that the largest display comes at this time, since three fourths of the lilac collection consists of *Syringa vulgaris* varieties. But it is still true that there is a continuous display of lilac blooms for a five-week period at least, and sometimes this is extended for another week or two if weather conditions remain favorable.

When some of the species are compared with the many beautiful varieties of *S. vulgaris*, they are found lacking in color, fragrance and size; but when the *S. vulgaris* varieties are not in flower for comparison, these species and their comparatively few varieties are of interest and contain several plants well worth including in many garden plantings. The Bulletin of Popular Information (May 20, 1936, Series 4 Vol. IV No. 8) contained considerable information concerning the care of lilacs, their history and some of the outstanding varieties of *S. vulgaris*, so that it is unnecessary to repeat that information here. However, it may be of interest to note the sequence in which these plants normally bloom.

The Arboretum lilacs are listed according to the times at which they start to bloom. Frequently they may remain in bloom sufficiently long so that they can be used ornamentally with lilacs in another group. Thus, *S. chinensis* and *S. persica* come into bloom after the *S. vulgaris* varieties have reached their peak, but still can be used at the same time effectively. As is the case with the seqence of bloom of other ornamental trees and shrubs, weather conditions may alter the dates. However, after comparing the records based on the lilac collection at the Arnold Arboretum for several years, we find that the following groups of species and their varieties bloom together.

SEQUENCE OF BLOOM

1. Blooming about May 10

Syringa oblata
" " affinis
" " dilatata
" " giraldi

2. Blooming about May 15

×Syringa hyacinthiflora *(S.oblata×S.vulgaris)*
" " Berryer
" " Buffon
" " Catinat
" " Claude Bernard
" " Descartes
" " Louvois
" " Mirabeau
" " Montesquieu
" " Necker
" " Pascal
" " Turgot
" " Vauban
" " Villars
" pinnatifolia

3. Blooming about May 20

Syringa vulgaris and its 300 varieties

4. Blooming about May 25

×Syringa chinensis *(S.persica×S.vulgaris)*
" " alba
" " bicolor
" " metensis
" " President Hayes
" " saugeana
" julianae
" meyeri
" microphylla
" persica
" " alba
" " laciniata
" " rubra
" pinetorum
" potanini
" pubescens

5. Blooming about June 5

×Syringa henryi *(S.josikaea×S.villosa)*
" " Floreal
" " Lutece
×Syringa josiflexa *(S.josikaea×S.reflexa)*
" " Enid
" " Guinevere
Syringa josikaea
" " H. Zabel
" " pallida
" " rosea
" " rubra
" komarowi

PLATE IV

The Japanese tree lilac *(Syringa amurensis japonica)* is the last of all lilacs to bloom and is the most conspicuous in flower. This tree was photographed in the Arboretum several years before the Hurricane destroyed the upper half of the tree.

×**Syringa prestonae** *(S.reflexa×S.villosa)*
" " **Audrey**
" " **Alice**
" " **Desdemona**
" " **Elinor**
" " **Isabella**
" " **Jessica**
" " **Miranda**
" " **Oberon**
" " **Octavia**
" " **Romeo**
" " **Ursula**
" " **Virgilia**
" " **W.T.Macoun**
" **reflexa**
" " **pallens**
×**Syringa swegiflexa** *(S.reflexa×S.sweginzowi)*
Syringa sweginzowi
" " **albida**
" **tomentella**
" " **superba**
" **villosa**

6. Blooming about June 15
Syringa amurensis
" " **japonica**
" **pekinensis**

Not all the lilacs listed are of outstanding ornamental value, and not all are available in the trade in this country. It may be of value to Bulletin readers if a few in each group are pointed out as being good ornamental additions to garden plantings.

Group 1. The broadleaf lilac *S.oblata* comes from northern China and is valued because it is the first of all the lilacs to bloom and also because it is the only lilac with a red to orange autumn color. Unfortunately, there are times when the flower buds are injured by severe winters. The leaves are rarely disfigured by the mildew so evident on the common lilac in late summer. The variety *dilatata* is perhaps the best because of its large lilac-pink flower clusters.

Group 2. The several named varieties of *S. hyacinthiflora* chiefly originated in France as a result of Victor Lemoine's hybridization at Nancy, France, and are of an intermediate lavender color. The varieties Turgot and Necker are probably the most prominent of the group. However, all the varieties of *S.hyacinthiflora* can be used for ornamental planting since they bloom slightly in advance of *S.vulgaris* and as a rule form larger growing and more vigorous shrubs. *S.pinnatifolia* is the least ornamental of any lilacs here listed.

Group 3. The Arboretum collection contains over 300 varieties of the common lilac. The better varieties, according to our selective list, were published in the Bulletin of May 20, 1936.

Group 4. This group of lilacs begins to bloom at the time the common lilac varieties are at their best. Both the Chinese and the Persian lilacs are valued for their lower habit of growth and for the larger

number of blooms produced every year. Frequently the varieties of the common lilac tend to bloom well one year but have comparatively few blossoms the year following. These two species, however, bloom profusely every year and so are particularly good for cutting purposes. Of the Chinese lilac varieties, *saugeana* is possibly the best because of its deep pink flowers. The cutleaf variety *(laciniata)* of the Persian lilac is also of value because of the feathery texture of its small lobed leaves. The hairy lilac *(S. pubescens)* is important because it is considered to be the most fragrant of all the lilacs, but the flowers are not as beautiful as those of the Chinese or Persian lilac or, in fact, those of most of the common lilac varieties. The blooms of the common lilac varieties last long enough so that they are still ornamental when the lilacs in Group 4 are at their best.

Group 5. Probably the best known of the varieties of *S. henryi* is Lutèce, noted for its large pale purple flower clusters which are not fragrant. This variety and the others in Group 5 are important for they bloom at a time when all the flowers of *S. vulgaris* varieties have faded. The variety Lutèce grows vigorously and is available from many nurseries.

The late lilac *S. villosa* is common in gardens, and justly so, because of its many creamy-white flower clusters and good dense habit of growth.

Two new hybrids are well worth growing, both being the result of Miss Isabella Preston's work at Ottawa, Canada. *Syringa prestonae*, named by Mrs. McKelvey in honor of Miss Preston, is a group of hybrids, the flowers of which contain a great deal of pink. Most of the lilacs blooming in early June have white flowers but, because the pink flowering *S. reflexa* is one parent, *S. prestonae* varieties are predominantly pink. This whole group is very important because the plants retain the vigorous growing qualities of *S. villosa* and some of the good color of *S. reflexa*. *Syringa reflexa* at the Arboretum has not proved a good shrub, though the individual flowers are very beautiful; but Miss Preston's hybrids are well worth growing in the United States. The second hybrid group has been named *S. swegiflexa*. At the Arboretum our plants are very small, but at Ottawa large plants are growing and clearly show that nurserymen in the United States would do well to grow at least a few of these varieties for their late flowers.

Group 6. The last of the lilacs is the largest growing of all—the Japanese tree lilac. This was formerly considered to be a separate species (and is listed by most nurserymen as *S. japonica*), but it is now considered to be a variety of *S. amurensis*. It forms a single trunk and has very conspicuous large creamy white flower clusters in mid-June. The bark is distinctly ornamental for it is very similar to that of *Prunus avium*. Where it is given sufficient space in which to expand, it develops into the most prominent of all lilacs.

Donald Wyman

ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. VIII JUNE 28, 1940 NUMBER 6

SOME ROSE SPECIES

ROSES are too little used in our present day landscaping. There may be several reasons for this, but after a careful examination of the types available, one is not surprised to find that there are certain species which deserve a place in almost every garden. Attention is here called to some of the more outstanding rose species for use in modern gardens.

The exact number of rose species has been a much debated point for many years. In 1892 Gandoger recognized 4266 species, while a few years before Bentham and Hooker recognized only 30—a rather striking difference of opinion! Be this as it may, Professor Alfred Rehder suggests that there are probably between 150 and 200 species of roses in the temperate and subtropical regions of the northern hemisphere. On the basis of Rehder's estimate, it is of interest to note that over one half of these occur in the living collections at the Arnold Arboretum, and that one nursery (Bobbink and Atkins) has recently listed 93 species and botanical varieties as being grown by them and ready for sale in the form of two year old, field grown plants. With these figures as a background, let us examine some of the important reasons why more of these rose species should be grown in the garden.

In the first place, as these are the wild roses of the world, they are entitled to a place in any wild garden, in the woodlands or at the border of roadways and woods. Every wild garden typical of New England should have at least one plant of the beautiful Virginia rose which is so prominent along our seacoast. Other species have been in cultivation for a long time. Centuries ago, before the advent of the "modern rose," it was these wild species which were grown and ap-

preciated in gardens. The native cabbage rose of Europe, for instance, has been grown for over two thousand years. At one time it was used a great deal in Greek garlands, and later played a prominent part in the social festivities of the Romans. Certainly such a rose, rich in historical background, might well find a place in our modern garden if for nothing else than sentiment alone!

Many of the rose species are far more hardy than the commonly grown hybrids. Gardeners living in the northern United States and Canada should remember this for it means less care and less winter protection. Also, the wild species are less susceptible to insect pests and disease troubles; and this means less dusting, spraying and pruning, important factors in keeping any garden looking at its best. It is these plants which require less care that should be more commonly grown, in order to reduce maintenance drudgery.

A formal rose garden is beautiful when the roses are in bloom. Many of the rose species, however, are valuable in the landscape because they are attractive at more than one season of the year. A species like the Virginia rose is of interest at every season of the year—in late spring and early summer when the light pink flowers appear, all through summer because of the shining dark green leaves, in the fall with its red fruits and beautiful orange autumn color, and in the winter because the red twigs and persistent fruits are bright colored throughout the cold season. It is such plants—those that are of interest at more than one season—that should be more commonly grown regardless of whether they are roses or dogwoods.

Of importance is the fact that these rose species are hardy shrubs and as such can be grown with other shrubs in the border or even in foundation plantings when desirable. Many of the hybrid varieties, so popular in formal rose gardens, cannot be so used, but most of the species can. They add variety and interest when planted with any group of shrubs, for their flowers, fruits and foliage, and frequently their twigs are unusual, and thus contribute to the landscape features.

There are many other reasons why rose species should be more commonly grown, but the points above made are sufficient to start a train of thought in the right direction. With these ideas in mind, then, let us examine a list of twenty-four rose species which have been selected for their wide variety in size and shape, color of their flowers, and also because of their wide adaptability for various landscape uses. This list does not contain all of the best forms but is merely offered to show the wide range of plants available, and in the hope that it will stimulate horticulturists to give this group of plants more

PLATE V

The Virginia rose (*Rosa virginiana*) as it grows in a border planting at the Arnold Arboretum.

attention. It is unnecessary to enumerate the merits of all these roses; consequently, only a few of the more outstanding are discussed in the following short paragraphs:

Rosa centifolia, the cabbage rose, has been mentioned in literature from as early as 270 B.C. It was one of the first wild roses introduced into cultivation and derives its name from the fact that its flowers were supposed to have one hundred petals. Being one of the few species with double flowers, several distinct varieties have evolved, one in particular designated as var. *mucosa*. This is the moss rose, so called because of the glandular moss-like excrescences of the sepals and flower-stalks. Many beautiful derivatives or selections have come down through the years from the moss rose, and even today it is one of the most interesting of roses in the older gardens.

Rosa damascena, the damask rose, another double flowering species, is a native of Asia Minor, and its pale pink to red flowers are very fragrant. It is one of the parents of the large class of hybrids called hybrid perpetuals. It was this rose that the early European hybridists started with and crossed in so many ways. It was probably grown in Gaul (France) and England by the early Romans. There is a variety called *versicolor*, which is credited as being the true York and Lancaster rose, and its history is interesting.

In 1455, Henry VI of the House of Lancaster was the ruler of all England. However, the Duke of York, head of the House of York, felt he should be ruler instead, and as a consequence a long and bitter war commenced, known as the war of the Roses which lasted until 1485. Those members of the House of Lancaster, and others loyal to it, selected the semi-double dark red *Rosa gallica*, or French rose, as their badge. Members of the House of York and its followers selected the white *Rosa alba* as their particular flower. As a result of long fighting, the throne passed between the two families until 1485, when Henry VII of the House of Lancaster was eventually proclaimed king. He married an heiress of the House of York in order to avert hard feelings, and shortly a new rose appeared. On the same bush grew red flowers and pure white flowers and some that where both red and white. This is supposed to have been *Rosa damascena versicolor*, or the York and Lancaster rose, symbolic of the final union of the House of Lancaster and the House of York. It is of interest to note in this connection that in the true York and Lancaster rose, the variegated flowers have white or red (or pink) petals and are not striped. Sometimes the striped flowers of *R. gallica versicolor* are assumed to represent the true York and Lancaster rose, but this is incorrect.

Rose Species for Landscape Use

Botanical Name	*Common Name*	*Single or Double*	*Color*
R. bella	[1]Solitary Rose	S	bright rose
R. blanda	[3]Meadow Rose	S	rosy pink
R. canina	[2]Dog Rose	S	white to light pink
R. centifolia	[2]Cabbage Rose	D	red
R. cinnamomema	[1 2]Cinnamon Rose	S	purplish red
R. damascena	[2]Damask Rose	D	pale pink to red
R. eglanteria	[2]Sweetbrier Rose	S	pale pink
R. foetida	[1]Austrian Brier Rose	S	deep yellow
R. gallica	[2]French Rose	S	dark red
R. helenae	[1]Helen Rose	S	white
R. hugonis	[1]Father Hugo's Rose	S	yellow
R. moyesi	[1]Moyes Rose	S	dark red
R. multiflora	[1]Japanese Rose	S	white
R. omeiensis	[1]Mount Omei Rose	S	white
R. palustris	[3]Swamp Rose	S	pink
R. primula	[1]Primrose Rose	S	yellow
R. rubrifolia	[2]Redleaf Rose	S	deep red
R. rugosa	[1]Rugosa Rose	S	purplish red
R. setigera	[3]Prairie Rose	S	deep rose
R. spinosissima	[1 2]Scotch Rose	S	white to pale pink
R. virginiana	[3]Virginia Rose	S	pink
R. wichuraiana	[1]Memorial Rose	S	white
R. willmottiae	[1]Willmott Rose	S	rose purple
R. xanthina	[1]Korean Rose	S and D	yellow

[1]Native of China, Korea or Japan [2]Native of Europe

[3]Native of North America

There are several yellow roses in the list, the hardiest of which is *R. hugonis* (Father Hugo's). This rose is a sturdy plant, a vigorous grower producing bright yellow single flowers in late May. It is reported that in some sections of Westchester County, N.Y., this rose is susceptible to a certain stem canker; but where this disease is not prevalent, Father Hugo's rose can be considered as one of the hardiest and earliest of all. The Persian Yellow rose, *R. foetida persiana*, might also be added for it is a beautiful rose with double flowers that are a deeper golden yellow color than Harison's yellow.

Rosa primula, another single yellow rose is just as early in bloom and is as hardy as *R. hugonis*. Splendid plants of this rose are growing in the Arboretum and are now about six feet tall. It would be an excellent substitute for Father Hugo's rose in situations where the latter is susceptible to canker.

Rosa harisoni is really not a wild species but a hybrid, originated by the Reverend Harison of Trinity Church in New York about 1830. It is mentioned here because it is the most common of yellow roses. At one time it was considered to be a variety of *R. foetida*; actually it is a cross between *R. foetida* and *R. spinosissima*.

The Japanese rose, *R. multiflora*, was first introduced into the United States before 1868. It is covered with small, pure white flowers in early June. With wide arching branches, vigorous growth, and bright red fruits which remain on the plant a greater part of the winter, the Japanese rose has been used considerably as one of the parents of the rambler roses; and, in fact, one of its varieties (*carnea*), first coming to England from China in 1804, had double red flowers.

The redleaf rose (*R. rubrifolia*) is outstanding among other shrubs because of its dark reddish foliage. It blends with green foliage extremely well, and should be classed with *Eleagnus angustifolia* as one of the really good foliage plants that can be used for modifying an unbroken line of green when desirable.

It is impossible to say too much in favor of the "sea tomato" of Japan, *Rosa rugosa*. It is widely planted in the eastern United States and has become naturalized in various places. It grows vigorously within reach of salt water spray, and survived a complete submergence under salt water as the result of the New England hurricane of September, 1938. Several varieties are available with single or double flowers. The fruits are large and beautiful in the fall and the foliage takes on an orange color—one of its chief merits for fall use. It is well adapted for use in hedges and as barriers, and is not subject to serious diseases.

Probably one of the best of the North American roses from the landscape point of view is *Rosa setigera*. It grows from six to twelve feet high, with wide-arching, thorny branches, and is covered with pink blossoms in the early summer. This is the last of the rose species to bloom, and should be used only in situations where it can run rampant, unrestrained by too much pruning.

The Scotch rose, *R. spinosissima*, is the most widely distributed rose in the world, being found from the British Isles to Japan. Incidentally, it is the only rose native of Iceland. Growing about four feet tall, it makes a dense, compact thorny mass of stems and foliage. The prickles are straight and of different lengths but very pronounced. The flowers are normally single and vary from white to pale pink, although forms or varieties occur even with red flowers, and double-flowered forms are known, while one variety *(lutea)* has yellow flowers.

Much could be written about the rose species given in the accompanying list and others not included therein. It is urged that gardeners study these plants and select a few for inclusion in the garden. They bring interest and color everywhere, and afford a close connection with the horticulture of past centuries.

Donald Wyman

REHDER'S MANUAL OF CULTIVATED TREES AND SHRUBS

A second edition of this work[1] first published in 1927 has just been issued. It has been brought up to date by the addition of numerous new introductions, the inclusion of the results of recent studies of certain groups, and the revision of the botanical names in conformity with the decisions of the last International Botanical Congress. The number of species fully described and mentioned in the keys has increased from 2350 to 2535 and of varieties from 2465 to 2685; the number of species and hybrids only briefly described has increased accordingly. Some genera, as *Rosa*, have been entirely rearranged, and in *Rhododendron* the number of species fully described has increased from 62 to 86. The general use of the term var. for all subdivisions of the species has been given up and the names are cited as trinomials with the author's name followed by the exact rank of the subdivision (subspecies, variety, form, lusus) as given by the original author of the combination. This will satisfy both the horticulturist and the systematic botanist. The zones of hardiness have been reduced from eight to seven and the small map of the climatic zones in the first edition has been replaced by a full page size map with the zones clearly indicated in color. The explanation of author's names, restricted in the old edition only to abbreviations of less than 500 names, contains now about 1250 entries with full names, dates, and country. The index of plant names contains over 14,400 names cited in the book.

[1]Rehder, Alfred, MANUAL OF CULTIVATED TREES AND SHRUBS hardy in North America exclusive of the subtropical and warmer temperate regions. Second edition revised and enlarged. XXX. 996 pp. map O. Macmillan Co., New York, 1940. Price $10.50

ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. VIII JULY 19, 1940 NUMBERS 7-10

A BRIEF GLOSSARY OF THE MORE COMMON BOTANICAL AND HORTICULTURAL TERMS[1]

aberrant - differing from usual structure, departing from the type; used mostly of variation.

abortive - barren; imperfectly or not developed; as abortive stamens when only filaments are present.

acaulescent - stemless; as in the dandelion.

achene - a small, dry, indehiscent, one-celled and one-seeded fruit; as in the buttercup.

acuminate - having a gradually diminishing point; long pointed.

adnate - grown to, united with another part; stamens adnate to the corolla-tube.

adventitious buds - those produced abnormally as from the stem instead of the axils of the leaves.

adventive - applied to an introduced plant, not definitely established or naturalized.

alate - winged; furnished with an expansion, as found on the stem or petiole.

ament - a catkin; a spike of flowers usually bracteate and frequently deciduous, as the male flowers of willow, birch, beech and oak.

androecium - the male or stamen bearing part of the flower. See also **gynoecium**.

[1]This glossary is merely a selective compilation of the more common technical terms used in horticultural literature and is recorded here as an aid to horticulturists and amateur gardeners who do not have easy access to the many well prepared glossaries already in existence. The works of many authors have been utilized, among them L.H.Bailey, A.Gray, B.D.Jackson, A.Rehder, A.B. Stout, et al.

angiosperms - plants having their seeds enclosed in an ovary. See also **gymnosperms.**

anther - the pollen bearing part of the flower.

anthesis - flowering; strictly the time of expansion of a flower; often used to designate the flowering period.

apetalous - without petals; as in willows.

apomictic hybrid - hybrid which can be reproduced true to type from seed, which develops without fertilization.

appressed - lying flat and close against.

articulate - jointed: having a node or joint where separation may take place naturally.

asexual - destitute of male or female organs;

asexual reproduction - reproduction produced vegetatively; without the aid of sexual organs.

attenuate - tapering slenderly; applied usually to the apex of a leaf.

auriculate - furnished with ear-shaped appendages (auricles), as the base of a petal or leaf.

awl-shaped - tapering from the base to a slender or stiff point.

awn - a bristle-like appendage.

axil - the upper angle formed by a leaf or branch with the stem.

axillary - situated in the axil.

baccate - berry-like; pulpy or fleshy as in the gooseberry.

barb - hooked hair, frequently doubly hooked.

barbellate - finely barbed.

basifixed - attached or fixed by the base.

beaked - ending in a beak or prolonged tip.

bearded - furnished with a tuft of hairs.

berry - an indehiscent fruit developing from a single ovary, having few to many seeds and a fleshy or pulpy outer wall: as the tomato or gooseberry. See also **drupe** and **pome.**

bi or **bis** - Latin prefix signifying two or twice.

bicolored - two-colored.

biennial - a plant which requires two years to complete its life-cycle; as the hollyhock.

bifid - two cleft.

bifoliolate - a leaf composed of two leaflets.

bigener (bigeneric hybrid) - plant hybrid resulting from a cross between two genera.

bilabiate - two-lipped; as in flowers of *Salvia.*

bilocular - two-celled.

binomial - the combination of a generic and specific name to denote a given organism; as *Acer rubrum*.

biotype - an elementary stable form.

bipinnate - twice pinnate; when the divisions of a pinnate leaf are again pinnately divided.

bisexual - having both stamens and pistils.

blade - the expanded portion of a leaf.

bloom - (1) See blossom. (2) The white waxy or pruinose covering of many fruits and leaves.

blossom - the flower, more often applied to those of fruit trees.

bract - a much reduced leaf, particularly the small or scale-like leaves in a flower-cluster or associated with the flowers.

bracteate - having bracts.

bracteolate - having bractlets.

bractlet - bract borne on a secondary axis, as on the pedicel.

breed - a group of plants having distinctive qualities in common, which, developed through the influence of man, requires control by man to prevent mixtures with other groups; does not imply directly traceable descent from any particular plant and may be propagated from seed.

bristle - stiff hair.

bud - the nascent state of a flower, leaf or branch.

bud mutation - an abnormal shoot, (caused by genetical change) which can be propagated only asexually.

bud-scale - covering of a bud.

bud-sport - same as bud-mutation.

bud-variation - same as bud-mutation.

bulb - a modified bud with fleshy scales, usually underground.

bulbil - a diminutive bulb.

bullate - blistered or puckered; as the leaf in Savoy cabbage.

bush - a low, several-to many-stemmed shrub, without distinct trunk.

caducous - falling off early.

callus - a hard prominence or protuberance; in a cutting or on a severed or injured part, the roll of new covering tissue.

calyx - the outer perianth of the flower.

campanulate - bell-shaped.

canescent - gray-pubescent and hoary.

capitate - head-like; collected in a dense cluster.

capsule - a dry fruit of more than one carpel, opening at maturity.

carinate - keeled.

carpel - a simple pistil or a member of a compound pistil.

catkin - a deciduous spike of unisexual, apetalous flowers. See **ament.**

caudate - having a slender, tail-like appendage.

caudex - the main axis of a plant, including both stem and root.

caulescent - more or less stem-bearing; having an evident stem above ground.

cauline - belonging to the stem, as cauline leaves.

cell - one of the minute compartments or vesicles of which plants are composed or made up; also a cavity of an anther or ovary.

cespitose (or **caespitose**) - growing in tufts; forming mats.

channeled - deeply grooved longitudinally.

chartaceous - having the texture of stiff writing paper.

chimera - graft hybrid exhibiting characters of both the stock and the scion, caused by the fusion of tissues of both;

periclinal chimera - one in which the cells of one have grown completely around the cells of the other;

sectoral chimera - chimera in which the two different cell masses merge but one does not completely encircle the other.

chlorophyll - the green coloring matter within the cells of plants.

choripetalous - having separate petals; polypetalous. See also **gamopetalous.**

ciliate - fringed with hairs.

ciliolate - minutely ciliate.

cinereous - ash-colored, light gray.

circumscissile - opening or dehiscing by a regular transverse line of division.

clavate - club-shaped; said of a long body thickened toward the top.

cleistogamous - closed self-fertilized flowers; as in some violets.

clon - a group of plants composed of individuals produced vegetatively from a single original plant; clons differ from races and strains in failing to come true from seeds; examples: Concord-grape, Baldwin-apple.

coalescence - the union of similar parts or organs, or of those in the same series as stamens with stamens and petals with petals.

coalescent - two or more similar parts united.

columnar - having the shape of a column.

compost - a soil mixture containing balanced plant requirements.

compound - of two or more similar parts united into one whole;

compound-leaf - one divided into separate leaflets.

conifer - cone bearing (not synonymous with evergreen).

connate - joined in one organ.

connective - the portion of the stamen which connects the cells of the anther.

cordate - heart-shaped; usually referring to the base of the leaf.

corolla - the inner series of floral envelopes consisting either of connate or distinct petals.

corm - the enlarged fleshy base of a stem, bulb-like but solid, as in gladiolus.

corymb - a flat-topped or convex flowering cluster with the outer flowers opening first. See also **cyme.**

costa - a rib; the midrib or middle-nerve of a leaf.

cotyledon - the primary leaf or leaves in the embryo.

creeper - a trailing shoot that produces roots at intervals.

crenate - toothed with rounded, shallow teeth.

cross - hybrid of any description.

cross-fertilization - fertilization secured by pollen from the flower of another plant.

cross-pollination - transfer of the pollen of one flower to the pistil of another.

crustaceous - having a hard or brittle covering.

culm - the stem of grasses and sedges.

cultigen - a plant, group, or series known only in cultivation. See also **indigen.**

cultivar - so-called "horticultural variety" or "garden variety". Progeny of a clon, chimera, or the result of selective hybridization, which is known only in cultivation and may or may not be reproduced from seed. The name, usually selected by the propagator, appended to either a generic name or a binomial, should be set off by different type or included within quotations to distinguish it from the binomial of a natural species. Examples: *Syringa* Congo or Syringa **Congo;** Malus "Bob-White"; Deutzia scabra "Pride of Rochester".

cuneate - wedge-shaped; triangular with narrow end at point of attachment.

cupular - cup-like or cup-shaped.

cupule - cup of such fruits as the acorn.

cuspidate - sharp-pointed.

cutting - a severed vegetative or asexual part of a plant used in propagation; as a cutting of root, of stem, or of leaf.

cyme - a convex or flat flower-cluster with the central flowers opening first. See also **corymb.**

cymose - arranged in cymes; cyme-like.

cytology - the branch of biology which treats of cells, especially of their internal structure.

damping off - collapse of seedlings usually ascribed to the attack of fungi.

deciduous - falling, not persistent, as the leaves of non-evergreen trees.

decompound - more than once compound.

decumbent - reclining or lying on the ground but with the ends ascending.

decurrent (leaf) - extending down the stem below the insertion.

decussate - opposite leaves in four rows up and down the stem; alternating in pairs at right angles.

defoliation - the casting or falling off of leaves.

dehiscence - the method or process of opening of a seed-pod or anther. See also **indehiscent.**

deltoid - triangular; delta-like.

dentate - with more or less spreading teeth.

di, dis - Greek prefix signifying two or twice.

diadelphous - in two groups, as the stamens of some *Leguminosae*, joined by their filaments.

diandrous - with two stamens.

dichotomous - forked regularly in pairs.

dicotyledons (dicots) - plants having two cotyledons or seed-lobes; see also **monocotyledons.**

diffuse - loosely or widely spreading.

digitate - with the members rising at one point.

dimorphous - occurring in two forms.

dioecious - staminate and pistillate flowers on different plants. See also **monoecious.**

dissected - divided into many narrow segments.

dissipiment - a partition in an ovary or fruit.

distichous - disposed in two vertical ranks, as the florets in many grasses.

divaricate - spreading, widely divergent.

divided - separated to the base.

dorsal - relating to the back or outer surface of an organ.

drupe - a fleshy indehiscent fruit with a bony, usually one-seeded endocarp; like the cherry or peach.

e or **ex** - Latin prefix usually denoting parts are missing, as **ebracteate** or **exstipulate** meaning without bracts or without stipules.

ellipsoid - a solid body, elliptic in section.
elliptic - a flat part or body that is oval and narrowed to rounded ends.
emarginate - with a shallow notch at the apex.
embryo - the rudimentary plantlet within the seed.
endemic - native or local.
epigynous - borne on the top of the ovary. See also **hypogynous** and **perigynous**.
epiphytic - growing on other plants but not parasitic.
ericoid - of leaves which are like those of heaths.
escape - a cultivated plant found growing as though wild, dispersed by some agency.
espalier - a fruit tree trained lattice-fashion in one plane.
evergreen - remaining green throughout the year as pines and some rhododendrons. Does not necessarily refer to cone-bearing plants. See also **deciduous**.
excurrent - with a projecting tip, as the nerve of a leaf projecting beyond the margin; the trunk of a tree with undivided main stem, as in the fir.
exfoliating - peeling off in thin layers; as the bark of the birch.
exotic - foreign, not native.
exserted - prolonged beyond the surrounding organs, as stamens from the corolla.
exsiccatae - dried, pressed specimens.
exstipulate - without stipules.
eye - the marked center of a flower; a bud on a tuber, as on the potato; a single-bud cutting.

falcate - sickle-shaped.
fasciated - an abnormal widening and flattening of the stem or branches.
fascicle - a dense cluster.
fastigiate - with close, and erect branches, as in the Lombardy poplar.
ferrugineous - rust-colored.
fertile - capable of producing fruit and seeds; also said of pollen-bearing anthers.
fertilization - effect of pollen deposited on a stigmatic surface resulting in conversion of flower into fruit and of ovule into seed.
filament - stalk of the anther.
filiform - thread-like; long and very slender.
fimbriate - fringed.
flaccid - not rigid; lax and weak.

floccose - clothed with tufts of soft hair or wool.

florets - small individual flowers of compact heads or spikes.

floriferous - flower-bearing, usually in the sense of abundantly flowering.

foliaceous - leaf-like in texture or appearance; said particularly of sepals and calyx-lobes and of bracts that in texture, size or color look like small or large leaves.

-foliate - in combinations, -leaved; having leaves; as tri-foliate, *three-leaved*, as the stem of trillium. Often confused with trifoliolate.

-foliolate - having leaflets; as trifoliolate, *of three leaflets.*

follicle - dry, dehiscent pericarp opening only along one suture; as the milkweed or peony.

form - sub-division of a variety or species usually differing in one character and usually perpetuated vegetatively.

frond - leaf of fern; sometimes used in the sense of foliage.

fructiferous - producing or bearing fruit.

fructification - the act or process of fruiting; also the fruiting organ.

fruit - the seed-bearing product of a plant.

frutescent - nearly shrubby.

fruticose - shrubby; with woody persistent stems and branches.

fugacious - falling or withering away very early.

funnelform - said of a corolla with the tube gradually widening upward; as in the morning-glory.

furrowed - with longitudinal channels or grooves.

fusiform - spindle-shaped; narrowed toward both ends from a swollen middle; as in the roots of the dahlia.

gamopetalous - having the petals more or less united. See also **choripetalous** and **polypetalous.**

gamosepalous - calyx of one piece: sepals united.

geniculate - bent abruptly like a knee.

germination - the development of the plantlet from the seed.

glabrate - nearly glabrous or becoming glabrous with age.

glabrous - not hairy.

gladiate - sword-shaped or sword-like.

gland - a definite secreting structure on the surface embedded in or ending a hair; also any protuberance of the like nature which may not secrete, as the warty swellings at the base of the leaf in the cherry and peach.

glandular - bearing glands or gland-like appendages.

glaucous - covered with a bloom; bluish white or bluish gray.

glochidiate - barbed; tipped with barbs.
glomerate - in compact clusters.
glume - a chaff-like bract; particularly one of two empty bracts at the base of the spikelet in grasses.
gourd - a fleshy one-celled many-seeded fruit; like the melon.
graft - a branch or bud inserted on another plant with the intention that it will grow there; a scion.
graft-hybrid - plant showing influences of scion and stock caused by mechanical union of the tissues. See **chimera.**
grafting - the process of inserting a scion in a plant (stock) with the intention that the tissues of both shall unite and that the stock shall furnish the nourishment for the growth of the scion.
granular, granulose - composed of or appearing as covered by minute grains.
gymno - in Greek compounds, signifying naked or not covered.
gymnosperms - plants with uncovered ovules, as the conifers; see also **angiosperms.**
gynoecium - the female or pistil-bearing part of the flower. See also **androecium.**

habit - the general aspect of a plant, or its mode of growth.
hastate - halberd-shaped; like an arrowhead but with the basal lobes pointing outward nearly at right angles.
head - a dense cluster or short dense spike of sessile or nearly sessile flowers.
heel - an enlarged or more or less transverse part on the lower end of a cutting secured from the older or larger branch from which the cutting is taken.
heliotropism - the characteristic of turning toward the light.
herb - a plant not woody, at least above ground.
herbaceous - of the texture of an herb; not woody.
heterogen - group of plants heterozygous from hybridity or mutation among which there are several phenotypes. Individuals here may be propagated as clons, or cultivars may be segregated by selective breeding. Example: Japanese azalea.
heteromorphous - parts of different shape.
heterophyllous - with two sorts of leaves.
hip - the fruit of the rose.
hirsute - with rather coarse or stiff hairs.
hirtellous - minutely hirsute.
hispid - beset with rigid hairs or bristles.

hispidulous - diminutive of hispid.

homo - in Greek compound, all alike or of one sort.

homogamous - bearing only one kind of flowers.

horny - hard and dense in texture.

host - a plant which nourishes a parasite.

humus - decomposing organic matter in the soil.

humus soils - garden soils enriched with organic manure.

hyaline - transparent or nearly so.

hybrid - a plant resulting from a cross between two or more parents that are more or less unlike.

hybridization - (1) the art of obtaining hybrids by artificial crossing; (2) also used for the same operation occurring naturally.

hydrophytes - water plants, partially or wholly immersed.

hygrophytes - marsh plants, or plants which need a large supply of moisture for growth.

hypanthium - the cup-shaped or tubular receptacle on which the perianth and the stamens are inserted; as in the flower of the cherry.

hypogynous - borne on the receptacle beneath the ovary; said of stamens and petals. See also **epigynous** and **perigynous.**

imbricate - overlapping, as shingles on a roof; as the bud-scales of horse-chestnuts and azaleas.

impari-pinnate - pinnate with a single leaflet at the apex; odd-pinnate. See also **pari-pinnate.**

imperfect flower - having either stamens or pistils, but not both. See also **perfect flower.**

inarching - grafting by approach, the scion remaining attached to its parent, until union has taken place.

incanescent - hoary or gray-pubescent.

incised - cut sharply into the margin.

indehiscent - not opening by valves or along regular lines. See also **dehiscent.**

indigen - a plant of known origin growing spontaneously or in cultivation. See also **cultigen.**

indigenous - original to the country, not introduced.

indumentum - any covering, as hairiness.

inferior ovary - one that is below the perianth. See also **superior ovary.**

inflorescence - disposition of the flowers on the floral axis.

infructescence - the inflorescence in a fruiting stage.

infundibuliform - funnel-shaped.

insectivorous - used of those plants which capture insects and absorb nutriment from them.

insertion - mode or place where one body is attached to its support.

integument - covering of a body or organ; envelope of an ovule.

internode - the space or portion of stem between two nodes.

introduced - used of plants which have been brought from another country; exotic.

involucre - a whorl or set of bracts around a flower, umbel or head, etc., as in the heads of composites and the flowering dogwood.

involute - having the edges of the leaves rolled inwards.

irregular flower - some parts different from other parts of the same whorl; usually applied to zygomorphous flowers.

keel - a projecting ridge on a surface, like the keel of a boat; the two front petals of a papilionaceous corolla.

key or **key fruit** - a winged-fruit, like in the maples; samara.

knee - an abrupt bend in a stem or tree-trunk; an outgrowth of some tree-roots.

labellum - lip, particularly the odd petal in orchids.

lacerate - with margins appearing as if torn.

laciniate - cut into deep narrow lobes.

lactescent - producing milky juice; as in the milkweeds.

laevigate - smooth, as if polished.

lanate, lanose - woolly, clothed with soft entangled hairs.

lanceolate - lance-shaped, about four times long as broad and broadest below or about the middle.

lanuginose, lanuginous - woolly or cottony; with long and interwoven hairs.

latex - the milky juice of such plants as the milkweed.

latifoliate, latifolious - broad-leaved.

leaching - losing material by percolation, as rain washing away nutriment through the soil.

leader - the primary or terminal shoot of a tree.

leaf - the principal appendage or lateral organ borne by the stem or axis. **Simple-leaf** - when undivided, **compound-leaf** - when divided into distinct parts.

leaf-scar - the mark or cicatrix left by the fall of a leaf.

leaf-stalk - the stem of a leaf, petiole.

leaflet - the separate division of a compound-leaf.

legume - seed vessel or pod of the pea or bean family, usually dehiscing by both sutures.

lemma - the lower of the two bracts enclosing the flower in the grasses.

lenticel - lens-shaped spots on young bark corresponding to the stomata on the leaf.

lepidote - with small scurfy scales.

liana, liane - a woody climbing or twining plant.

ligneous - woody.

ligule - the strap-shaped corolla in the ray florets of composites; the membranous appendage at the summit of the leaf-sheaths of most grasses.

linear - long and narrow with nearly parallel margins.

lip - the principal lobes of a bilabiate corolla or calyx.

loam - combination of clay with enough sand to counteract the cohering property of the clay; usually implies the presence of considerable decomposed organic matter with accompanying fertility.

lobed - divided into or bearing lobes.

loculicidal - dehiscent on the back of the cells of a capsule. See also **septicidal.**

lyrate - pinnatifid with a large terminal lobe and small basal lobes.

macro - in Greek compounds meaning long, large, or great.

maculate - blotched or spotted.

male (flowers or plants) - having stamens but no pistils.

marcescent - withering but not falling off.

midrib - the central vein or rib of a leaf; costa.

monadelphous - stamens united in one group by their filaments.

moniliform - resembling a string of beads like the legume in *Sophora*.

mono - in Greek compounds meaning one.

monocotyledons (monocots) - plants having one cotyledon or seed-lobe, as lilies and grasses; see also **dicotyledons.**

monoecious - with unisexual flowers of both sexes on the same plant. See **dioecious.**

muck - any kind of impure or decayed peat or black swamp earth, especially when used as manure.

mucronate - tipped with a short abrupt point or mucro.

mulch - strawy dung or any other material, as leaves etc. spread on the surface of ground to protect the roots of newly planted shrub or tree.

mule - an old word for a cross, particularly between different species; hybrid; cross-breed; usually an infertile hybrid.

multiple fruit - the united product (in one body) of several or many

flowers; as the pineapple or mulberry. See also **syncarp.**

muricate - roughened with short hard points.

mutation - variation derived by sudden changes in seedlings. See also **bud-mutation.**

naked flower - a flower without perianth.

nectary - a place or organ where sugar or nectar is secreted.

nerve - a slender rib or vein, particularly if unbranched.

node - the place upon the stem which normally bears a leaf or leaves.

nut - an indehiscent one-seeded hard and bony fruit.

ob - Latin prefix usually signifying inversion.

oblanceolate - inversely lanceolate; with the broadest part of a lanceolate body away from the point of attachment.

oblique - slanting; unequal sided.

oblong - at least twice as broad as long.

obovate - inverted ovate.

obtuse - blunt, rounded.

odd-pinnate - see **impari-pinnate.**

offset - a plant arising close to the base of the mother plant.

oleaginous - oily and fleshy.

oligo - in Greek compounds meaning few.

opaque - applied to a surface means dull, not shiny.

orbicular - circular; rounded in outline.

ortet - the original plant from which a clon is derived.

ovary - that part of the pistil containing the ovules or future seeds.

ovate - having an outline like that of a hen's egg.

palea - the upper bract which with the lemma encloses the flower in grasses.

paleaceous - chaffy.

palmate (leaf) - radiately lobed or divided with three or more veins arising from one point.

panicle - a compound, usually loose flower-cluster, longer than broad as a branched raceme or corymb.

pannose - covered with a felt of woolly hair.

papilionaceous - butterfly-shaped; applied to such a corolla as that of the pea.

papillose - bearing minute nipple-shaped protuberances.

pappus - peculiar calyx-limb of composites, being plumose, bristle-like, scales or otherwise.

parasite - organism which grows on and derives nourishment from another plant, the host.

parietal - borne on or pertaining to the wall of a fruit.

pari-pinnate - pinnate with an even number of leaflets. See also **impari-pinnate.**

parted, partite - cleft nearly but not quite to the base.

parthenogenesis - producing seed without fertilization.

peat - carbonaceous substance formed by partial decomposition in water of various plants especially sphagnum; used as fertilizer or mulch.

pedicel - the stalk of a flower.

pedicellate - borne on a pedicel.

peduncle - the stalk of a flower-cluster; also used for the stalk of a solitary flower.

pedunculate - borne on a peduncle.

peltate - shield-shaped; attached to its stalk inside the margin, like the leaf of nasturtium (*Tropaeolum*) and nelumbium.

penninerved - nerves arising along a central midrib.

pentamerous - in fives.

pepo - a hard-rinded berry of the gourd family such as pumpkin, squash, etc.

perennial - of three or more seasons duration.

perfect flower - having both stamens and pistils; bi-sexual. See also **imperfect flower.**

peri - Greek prefix meaning around.

perianth - the floral envelope; commonly used when there is no clear distinction between calyx and corolla; as in the lilies.

pericarp - the wall of the ripened ovary.

perigynous - borne around the ovary and not at its base, as in flowers of cherry, where the perianth and stamens are borne on a cup-shaped hypanthium. See also **epigynous** and **hypogynous.**

persistent - remaining attached, not falling off; opposite of deciduous.

petal - one of the separate leaves of the corolla.

petiole - leaf-stalk.

petiolule - stalk of a leaflet.

phenotype - biotype of mixed individuals having like external characters but of unlike germinal composition.

pilose - with long straight hairs.

pinnate (leaf) - compound with the leaflets placed on each side of a rachis. See also **impari-pinnate** and **pari-pinnate.**

pinnatifid - cleft or divided in a pinnate way.

pistil - the seed-bearing organ of a flower consisting of ovary, style and stigma.
pistillate - having a pistil and no stamens.
placenta - part of the ovary which bears the ovules.
platy - Greek prefix meaning broad.
pleio - Greek prefix for full or abounding, or many.
plicate - folded into plaits.
plumose - feathery.
pluri - Latin prefix meaning many.
pod - a dry dehiscent fruit.
pollen - the fertilizing powder contained in the anthers.
poly - Greek prefix meaning many.
polycotyledonous - having several cotyledons.
polygamous - bearing unisexual and bisexual flowers on the same plant.
polypetalous - having separate petals; choripetalous. See also **gamopetalous.**
pome - a fleshy fruit like the apple and pear.
procumbent - trailing on the ground.
prickle - spine-like outgrowth from bark or epidermis.
pruinose - covered with a waxy, powdery secretion on the surface; a bloom.
pruning - artificial removal of twigs or branches from trees, shrubs, etc.
pseudo - Greek prefix for false, as **pseudo-bulb.**
puberulent, puberulous - minutely pubescent.
pubescent - covered with hairs, particularly if short and soft.
pulvinate - cushioned.
punctate - with translucent or colored dots or depressions.
pungent - prickly-tipped as in the holly; acrid.
pyrene - a seed-like nutlet or stone of a small drupe.
pyriform - pear-shaped.

quadri - Latin prefix meaning four; as **quadrangular** - four angled; **quadrifoliate** - four-leaved; **quadrifid** - four-cleft.
quaternate - in fours.
quinate - in fives.
quinque - Latin prefix meaning five; as **quinquelocular** - five-celled.

race - a permanent variety, or group of individuals whose distinguishing characters are constant and are reproduced true to type from seed.

raceme - a simple inflorescence of stalked flowers on a more or less elongated axis.

racemose - in racemes or resembling a raceme.

rachis - an axis bearing flowers or leaflets.

radiate - spreading from a common center; with ray-flowers.

ramet - any individual of a clon.

ray - the margin portion of a composite flower when distinct from the disk.

receptacle - the more or less expanded portion of an axis which bears the organs of a flower or the collected flowers of a head.

recurved - curved downward or backward.

reflexed - abruptly turned downward.

reniform - kidney-shaped.

repand - with a slightly sinuate margin.

reticulate - in the form of a network; net-veined.

retuse - slightly notched at the rounded apex.

revolute - rolled backward.

rhachis - see **rachis.**

rib - a primary or prominent vein in a leaf.

rostrate - beaked.

rufous - reddish brown.

rugose - wrinkled.

runcinate - coarsely saw-toothed or cut, the pointed teeth turned toward the base of the leaf; as in the dandelion.

runner - a slender and prostrate branch, rooting at the end or at the joint.

saccate - sac-shaped.

sagittate - shaped like an arrow-head, the basal lobes directed downward.

salver-shaped (flower) - with a slender tube abruptly expanded into a flat limb.

samara - an indehiscent winged fruit; see **key.**

scabrous - rough to the touch.

scale - a minute leaf or bract, usually appressed or dry.

scandent - climbing.

scape - a peduncle rising from the ground, naked or without proper foliage.

scarious - thin and dry, not green.

scion - a slip or shoot used for grafting; see **graft.**

scorpioid - coiled (ring-like) while in bud.

scrobiculate - pitted.
seed - the ripened ovule consisting of the embryo and its integuments.
sepal - a division of the calyx.
separation - multiplication of plants by means of naturally detachable asexual bodies or organs, as offsets, stolons.
septicidal - dehiscing along or in the partitions. See also **loculicidal**.
septifragal - where the valves in dehiscence break away from the partitions.
septum - a partition.
serrate - having teeth pointing forward.
serrulate - serrate with fine teeth.
sessile - without any stalk.
setaceous - bristle-like.
setose - beset with bristles.
sheath - a tubular envelope, as the lower part of the leaf in grasses.
shrub - a woody plant branched from the base.
sinuate - with the outlines of the margin strongly wavy.
sinus - the recess between lobes, as in the leaves of some oaks.
slip - a softwood cutting "slipped" off or pulled off; applied also to similar parts cut off.
spadix - a spike with a fleshy axis.
spathe - a large bract or pair of bracts inclosing the inflorescence; like Jack-in-the-pulpit.
spathulate - gradually narrowed from a rounded summit.
species - a natural botanical unit; composed of individuals which exhibit characters distinguishing them from all other units within a genus, still not differing from one another beyond the limits of individual diversity.
spicate - arranged in or resembling a spike.
spike - a simple inflorescence with the flowers sessile or nearly so on a common axis.
spine - a sharp-pointed woody outgrowth from the stem.
sport - a variation starting from a bud or seed.
spur - any projecting appendage of a flower, looking like a spur but hollow; like in larkspur.
stamen - the pollen-bearing male organ of a flower.
staminode, staminodium - a sterile stamen or similar structure inserted between the corolla and the pistil.
standard - the upper broad petal of a papilionaceous flower.
stellate - star-shaped; where several similar parts spread out from a common center, like a star.

stem - the axis or axes of a plant arising from its root.

sterile - barren; not fertile.

stigma - the part of the pistil that receives the pollen.

stipe - the stalk of a pistil.

stipitate - having a stipe.

stipule - an appendage at the base of the petiole, usually one on each side.

stock - the part on which the scion is grafted; the strain or parentage.

stolon - a subterranean stem.

stoloniferous - bearing stolons.

stoma (pl. **stomata**) or **stomate** - a breathing pore in the epidermis of the leaf leading into an intercellular space communicating with the internal tissue.

stool - a clump of roots or rootstalk that may be used in propagation; also an established low plant from which layers are taken.

strain - a group of plants differing from the race to which it belongs by no apparent morphological characters, but by some enhanced or improved physiological tendency propagated from seed; as heavier yield in fruit.

stratification - the operation or method of burying seeds to keep them fresh and to soften their integuments, or to expose them without injury to cold temperatures, that they may be more readily and successfully germinated.

striate - marked with fine longitudinal lines.

strict - very straight and upright.

strigose - beset with appressed straight and stiff hairs.

strike - to emit roots as from a cutting.

strobile - an inflorescence marked by imbricated bracts or scales; as in the pine-cone.

style - a stalk between the ovary and stigma.

subulate - awl-shaped.

succulent - fleshy; juicy.

sucker - a shoot arising from the roots or beneath the surface of the ground.

suffrutescent - slightly woody; woody at the base.

suffruticose - perennial plant with only the lower part of the stem and of the branches woody and persistent.

sulcate - grooved or furrowed.

superior ovary - borne above the insertion of the perianth and free from it. See also **inferior ovary.**

suture - a line of splitting.

syncarp - a fleshy aggregate fruit.

tendril - a coiling thread-like organ by which a plant grasps an object for support.
teratology - the subject of monstrosities, or of abnormal and aberrant forms and malformations.
terete - circular in cross section.
ternate - in threes.
testa - the outer seed-coat.
tetra - Greek prefix meaning four; **tetragonal** - four-angled; **tetragonous** - with four pistils or styles; **tetramerous** - with its parts or sets in fours; **tetrandous** - with four stamens.
tetradynamous - six stamens, four long and two short.
throat - the place where the limb of the corolla joins the corolla-tube.
thyrse - a compact narrow panicle.
tomentose - dense woolly pubescence.
tomentum - dense covering of matted hairs.
tortuous - twisted or bent.
tree - a woody plant with one main stem, and at least four to five meters tall.
tri - Latin prefix signifying three or thrice, as **trifoliolate** - with three leaflets.
truncate - the end nearly straight across; as the apex of the leaf in the tulip-tree.
tuber - a thickened portion of a subterranean stem or branch, provided with eyes (buds) on the sides.
tumid - swollen.
turbinate - top-shaped; inversely conical.
type - individual plant or part of plant (prepared and preserved) from which the description of a genus, species, variety, etc., has been prepared and upon which the scientific name has been based.

umbel - an inflorescence with pedicels or branches arising at the same point and of nearly equal length.
undulate - wavy surface or margin.
uni - in compound words meaning one.
unisexual - of one sex, either staminate or pistillate.
urceolate - urn- shaped.
utricle - a small bladder; a bladdery one-seeded fruit.

vaginate - sheathed, or surrounded by a sheath.

valvate - opening by valves; meeting by the edges without overlapping as leaves or petals in the bud.

variety (as a botanical unit) - a sub-division of the species composed of individuals differing from other members of the species in certain minor characters which are usually perpetuated through generations by seed.

vascular - with vessels or ducts.

veins - the small ribs or branches of the framework of leaves.

velutinous - velvety.

venation - arrangement of veins.

ventral - relating to the inner surface or part of an organ; the part nearer the axis.

ventricose - swelling unequally, or inflated on one side.

vernation - the arrangement of leaves in the bud.

verrucose - covered with wart-like elevations.

versatile - relating to an anther attached near the middle and moving freely on its support.

verticillate - disposed in a whorl.

villous - bearing long and soft, usually curved or curly, hairs.

viscid - glutinous; sticky.

whorl - the arrangement of three or more like organs in a circle around the axis.

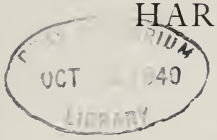
wing - any membranous expansion.

woolly - clothed with long and entangled soft hairs.

zygomorphic - said of a flower which can be bisected only in one plane in similar halves.

CLARENCE E. KOBUSKI

ARNOLD ARBORETUM
HARVARD UNIVERSITY



BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. VIII OCTOBER 25, 1940 NUMBER 11

PROFESSOR ALFRED REHDER'S RETIREMENT

ON August the thirty-first of this year Professor Rehder retired from active service as Associate Professor Emeritus, after having been a staff member of the Arnold Arboretum for forty-two years.

Born at Waldenburg, Saxony, September 4, 1863, he became a gardener and later studied at the Universities of Berlin and Göttingen, after which he began his scientific career as assistant editor of Möller's Deutsche Gärtner-Zeitung, at that time one of the better known German horticultural publications. In 1898, at the age of thirty-five he came to the United States to study American trees and shrubs at their source. He was employed by the Arboretum as a working student for the summer, and at the same time maintained his connection with Möller's Deutsche Gärtner-Zeitung by writing articles for publication in that periodical. His intentions were to return to Germany in the autumn.

By mere chance he became associated with Professor L. H. Bailey of Cornell University who was beginning work on his Cyclopedia of American Horticulture and was engaged to prepare the data appertaining to the important genera of woody plants for that publication. A year later, Professor C.S.Sargent, director of the Arnold Arboretum, in initiating work on the Bradley Bibliography arranged that the important task of compiling the data for this monumental work be assigned to Professor Rehder. During the years 1904-1906 Professor Rehder worked in European botanical libraries compiling the detailed information needed for the preparation of the manuscript. The first volume of this Bibliography was not published until 1911. While the Bradley Bibliography was in the final stages of publication, Professor Rehder began the preparation of "Plantae Wilsonianae" the two great works appearing almost simultaneously.

On returning to the United States, after the completion of his

European library work on account of the Bradley Bibliography, he was appointed assistant in the herbarium at the Arnold Arboretum and in 1918 assumed the title of curator. Professor Rehder set the standard for productive taxonomic research at the Arnold Arboretum and vastly widened its scope. At the same time he greatly stimulated the expansion of the herbarium which under his leadership was increased rapidly until it now contains in excess of half a million specimens.

The year following his appointment as curator, Professor Rehder organized the Journal of the Arnold Arboretum as a vehicle for the publication of technical papers prepared by staff members, and from that date has been its editor. Fortunately, for the best interests of the institution, he has consented to continue as editor of this publication which he instituted twenty-two years ago. Eighty-four numbers have been published and seldom has an issue appeared without at least one article written by him, for during this period Professor Rehder made eighty-two contributions to the Journal. However, this is but a small fraction of his published botanical and horticultural papers which to date approximate 980 titles. We sincerely hope that time will permit him to increase this number to well over the thousand mark. (Reprinted from the Journal of the Arnold Arboretum XXI No. 4, Oct., 1940.)

Dr. A. C. Smith, formerly associate curator of the New York Botanical Garden, has been appointed curator of the Herbarium at the Arnold Arboretum, his duties beginning October 1, 1940. A graduate of Columbia University in 1926, Dr. Smith received his Ph. D. from that institution in 1933, doing his research work at the New York Botanical Garden. He has been very much interested in the plant explorations in tropical regions, having accompanied E. P. Kilip of the Smithsonian Institution into Colombia and later on another trip travelling from Lima, Peru, across the Andes and down the Amazon, studying the plants used by the South American Indians for fish poisons. He also spent nearly a year in Fiji (1933-34) on a fellowship from the Bernice P. Bishop Museum in Honolulu. Again in 1937-38 he made another trip to South America as botanist for the Terry-Holden expedition to British Guiana. Dr. Smith is the author of numerous botanical papers, dealing chiefly with the flora of tropical America, and Fiji. Previous to his appointment at the Arnold Arboretum, Dr. Smith was associate curator of the herbarium at the New York Botanical Garden.

Dr. E. D. Merrill, Director of the Arboretum, has been appointed by the President of the National Academy of Sciences as one of the

BACHRACH

Alfred Kelder

eight directors of the Canal Zone Biological Area. This area within the Canal Zone includes Barro Colorado Island, and is set aside by Congress as an area in which the natural features shall, except in event of declared national emergency, be left in their natural state for scientific observation and investigation. The Board of Directors includes the Secretaries of War, Agriculture, and Interior, the Secretary of the Smithsonian Institution, the President of the National Academy of Sciences, and three appointed members, Dr. Thomas Barbour (Director of the Museum of Comparative Zoology at Harvard), Dr. Alexander Wetmore (Assistant Secretary of the Smithsonian Institution), and Dr. E. D. Merrill.

A VALUED GIFT OF BOOKS

Mr. Ralph Lowell, Harvard 1912, and Mr. James H. Lowell, Harvard 1914, of Chestnut Hill, recently delivered to the Arnold Arboretum library a distinctly important assortment of botanical and horticultural publications. The gift, which is valued at more than $700.00, was made in memory of Mr. John Lowell, Harvard 1877, by his children, they being great grandchildren of Mr. George B. Emerson, Harvard 1817, who originated the idea of establishing an arboretum and who induced Mr. James Arnold to make provisions in his will with the hope that such an institution could be established (see Bull. Pop. Inf. ser. 4. 8: 1-11. 1940). With nearly 46,000 bound volumes on our shelves, one of the largest and most important botanical-horticultural libraries in the world, it is noteworthy that this recent accession should contain a number of important items new to the collection.

TROPICAL FRUITS

One of the recent publications of the Arnold Arboretum is a 131 page booklet entitled "Tropical Fruits for Southern Florida and Cuba and Their Uses," written by David Sturrock, Superintendent of the Atkins Institution of the Arnold Arboretum at Soledad, Cuba. Mr. Sturrock has been interested in tropical fruits which can be grown in southern Florida for a long time, and is well qualified to discuss the subject. Many introductions of recent years afford an excellent opportunity for enterprising fruit growers of the sub-tropical areas, and it is the author's hope in discussing many of these exotic fruits that the booklet will induce many local residents to appreciate more fully what is actually available to them, and that some may be inspired to develop local industries based on these exotic fruits, many of which cannot be grown in the United States outside the warmer parts of Florida. Over 125 fruits are discussed and some information given concerning the culture and potential economical possibilities of each. Because so little is known concerning some of these fruits, this booklet should go a long way in promoting interest in growing new fruits among southern Florida residents. (Price $1.25, at the Arnold Arboretum, Jamaica Plain, Massachusetts.)

ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. VIII NOVEMBER 1, 1940 NUMBER 12

A HARDINESS MAP FOR THE UNITED STATES

THE hardiness of plants is naturally of great interest to all plantsmen. It is only by long and careful trials that the northern limits of growth of any particular exotic tree or shrub can be determined. Even when the northern limits of a number of different species become known, it is somewhat difficult to divide the country into hardiness zones that are wholly satisfactory. Many such maps have been prepared, some reasonably satisfactory, others less so. After a careful consideration of all factors, it was felt that the best basis for limiting hardiness zones is the average annual minimum temperatures. The map here offered, first published in **Hedges, Screens and Windbreaks** by Donald Wyman in 1938, and later adopted and enlarged to include Canada by Alfred Rehder in the second edition of his **Manual of Cultivated Trees and Shrubs** (1940), is about as accurate as any small-scale map can be.

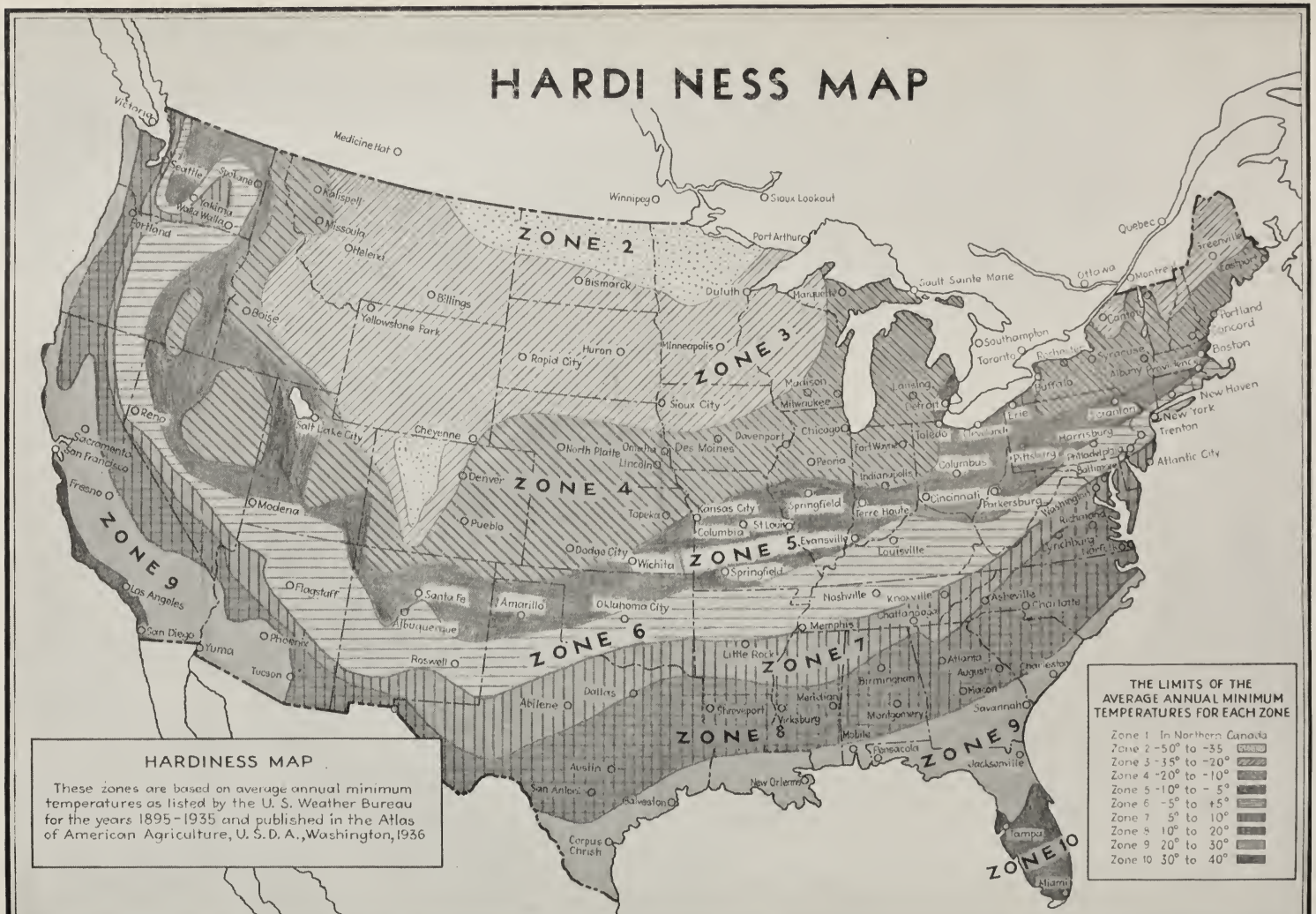
Hardiness of plants is an indeterminable quantity, based not only on a plant's resistance to minimum temperatures, but also on its resistance to maximum temperatures, and other factors such as lack of water, exposure, soil conditions, length of growing season, etc. It would be impossible to prepare a map depicting all these factors, though several might be included on a complex one. However, since a map based on the average annual minimum temperatures agrees in many instances with the known limits of hardiness of certain plants, these data were adopted as the basis for hardiness zones.

Figures for the average annual minimum temperatures were published by the U. S. Department of Agriculture in 1936, based on data compiled by the Weather Bureau over a period of forty years, 1895 to 1935, and these figures were used as a basis for the preparation of the Hardiness Map. For this purpose the United States and Canada were arbitrarily divided into ten zones, nine of which are in

the United States. These were based simply on 5, 10, or 15 degree differences in the average annual minimum temperatures. Professor Rehder used this same system in the first edition of his **Manual of Cultivated Trees and Shrubs** (1927); but since his work was published before the U. S. Weather Bureau figures were available, there are certain discrepancies between the zones as adopted by him and the temperature data as published in 1936. Professor Rehder's new revised **Manual** (1940) contains a map based on the later data and similar to the one shown in Plate VII, augmented somewhat by zone information for Canada.

On a small-scale map such as this, it is impossible to show all the minute climatic variations within the limits of each zone. In this same connection, certain strains of plants may prove hardier than others of the same species or botanical variety. Take, for instance, the Cedar of Lebanon (Cedrus libani) which was tried at the Arboretum unsuccessfully many times until seed was collected from the northernmost source of this plant in the Anti-Taurus Mountains in Asia Minor. Seedlings grown from this seed have proved perfectly hardy and have been growing in the Arboretum for the past 37 years. Similar variations in the hardiness of other plants of a single species or variety are common. If a map of any one of these zones were enlarged, various zone changes would be noted due to altitude alone. The Grand Canyon, for example, appears on our hardiness map in one climatic zone; yet there are at least four climatic zones in this one canyon, due, of course, to variations in altitude. Plants grow at the bottom of the Canyon which thrive in the Mexican deserts, yet on the North Rim (5700 feet above the Canyon floor) plants are found which are native as far north as southern Canada.

Consequently, many local variations in this small-scale map are to be expected. A plant is usually listed in the coldest zone where it will grow normally, but at the same time it can be expected to grow in many of the warmer zones where maximum temperatures and drought conditions might prove to be the only limiting factors. With these limitations in mind, the following plants are listed in the coldest zones where they can be expected to do well, simply as indicators for the large group of plants doing well in that particular zone. Using this general map as a basis and these lists of plants as indicators, similar hardiness maps could be worked out for limited areas or even for each state in the United States and each province in the Dominion of Canada, but in much greater detail. Such detailed maps would be of much greater value to local plantsmen than a general map covering the entire country, such as the one accompanying this article.


HARDI NESS MAP
Victoria
Seattle
Spokane
Yakima
Walla Walla
Portland
Medicine Hat
Kalispell
Missoula
Helena
Winnipeg
Sioux Lookout
Port Arthur
Quebec
Greenville
Eastport
ZONE 2
Bismarck
Duluth
Marquette
Sault Sainte Marie
Ottawa
Montreal
Billings
Boise
Yellowstone Park
Rapid City
Huron
Minneapolis
ZONE 3
Southampton
Toronto
Rochester
Syracuse
Albany
Providence
Boston
Portland
Concord
Canton
Madison
Milwaukee
Sioux City
Lansing
Detroit
Buffalo
Erie
Cleveland
Scranton
New Haven
New York
Trenton
Reno
Salt Lake City
Cheyenne
Chicago
Davenport
Des Moines
Omaha
Lincoln
North Platte
Fort Wayne
Toledo
Pittsburg
Philadelphia
Baltimore
Harrisburg
Atlantic City
Sacramento
San Francisco
Fresno
Denver
ZONE 4
Peoria
Indianapolis
Columbus
Cincinnati
Parkersburg
Washington
Richmond
Modena
Pueblo
Topeka
Kansas City
Springfield
St Louis
Columbia
Terre Haute
Evansville
Louisville
Lynchburg
Norfolk
ZONE 9
Dodge City
Wichita
ZONE 5
Springfield
Los Angeles
Flagstaff
Santa Fe
Amarillo
Oklahoma City
Nashville
Knoxville
Asheville
Charlotte
San Diego
Yuma
Phoenix
Albuquerque
Memphis
Chattanooga
ZONE 6
ZONE 7
Tucson
Roswell
Little Rock
Atlanta
Augusta
Charleston
Birmingham
Macon
Dallas
Abilene
Meridian
Shreveport
Vicksburg
Montgomery
Savannah
ZONE 8
Mobile
Pensacola
ZONE 9
Jacksonville
Austin
San Antonio
Galveston
New Orleans
Corpus Christi
Tampa
ZONE 10
Miami
HARDINESS MAP
These zones are based on average annual minimum temperatures as listed by the U. S. Weather Bureau for the years 1895-1935 and published in the Atlas of American Agriculture, U. S. D. A., Washington, 1936
THE LIMITS OF THE AVERAGE ANNUAL MINIMUM TEMPERATURES FOR EACH ZONE
Zone 1 In Northern Canada
Zone 2 -50° to -35°
Zone 3 -35° to -20°
Zone 4 -20° to -10°
Zone 5 -10° to - 5°
Zone 6 - 5° to +5°
Zone 7 5° to 10°
Zone 8 10° to 20°
Zone 9 20° to 30°
Zone 10 30° to 40°

WOODY PLANTS HARDY IN DIFFERENT ZONES

Zone I

(This includes the Arctic Regions of northern Canada.)

Zone II

Acer negundo
Caragana arborescens
Cornus alba
Juniperus virginiana
Prunus virginiana

Zone III

Euonymus alata
Ligustrum amurense
Lonicera tatarica
Philadelphus coronarius
Pinus strobus

Zone IV

Abies concolor
Betula populifolia
Juniperus chinensis
Ligustrum vulgare
Tsuga canadensis

Zone V

Abelia grandiflora
Berberis triacanthophora
Ilex opaca
Pieris japonica
Taxus cuspidata

Zone VI

Berberis buxifolia
Bignonia capreolata
Ilex crenata
Myrica cerifera
Taxus baccata

Zone VII

Abelia triflora
Ilex cornuta
Prunus laurocerasus
Pyracantha crenato-serrata
Quercus virginiana

Zone VIII

Euonymus japonica
Ligustrum japonicum
Melia azedarach
Myrtus communis
Pittosporum tobira

Zone IX

Berberis darwini
Cinnamomum camphora
Cotoneaster pannosa
Nerium oleander
Raphiolepis umbellata

Zone X

Buginvillaea spectabilis
Cocos nucifera
Hibiscus rosa-sinensis
Musa sapientum
Roystonea regia

INCREASING THE ENDOWMENT OF THE ARBORETUM

Since the work of the Arnold Arboretum is dependent on the income from its restricted endowment, plus gifts for special or general purposes from its friends, it is very gratifying to report increases in the General Endowment Fund. Recently this Fund has been increased by two bequests totalling $35,554.90. Of this, $12,500.00 was from the estate of Miss Grace L. Edwards, formerly of Beacon Street, Boston, this being the final payment of her bequest of $25,000.00; and $23,054.90 from the estate of Mrs. James G. Freeman, formerly of Boston and Weston. The latter is added to the Laura Lucretia Case Fund which was established in 1925, the income to be used for the general purposes of the Arboretum. It is interesting to note that the total endowment of the Arnold Arboretum is made up of thirty-four different items, each being carried under the names of the individual donors.

GLOSSARY

The "Brief Glossary of the More Common Botanical and Horticultural Terms" published by the Arnold Arboretum as Bulletin Nos. 7-10 of the **Bulletin of Popular Information** (July 19, 1940) has proved overwhelmingly popular. A few copies of this still remain and can be purchased for 25 cents from the Arnold Arboretum, Jamaica Plain, Massachusetts.

DIRECTIONS FOR THE PREPARATION OF HERBARIUM SPECIMENS

The thirty-five page illustrated booklet by Dr. I. M. Johnston, entitled **The Preparation of Botanical Specimens for the Herbarium,** issued last year by the Arboretum, has proved to be so popular that the original edition is now exhausted. It is to be reprinted in a larger edition. Copies may be obtained from the Arnold Arboretum, price: 30 cents, prepaid.

INSECT PEST BOOKLET

An important booklet entitled **Important Tree Pests of the Northeast** has recently been published by the Massachusetts Forest and Park Association. This contains descriptions of 50 of the most important pests, written by a dozen or more experts. Full descriptions, pictures, and control are given for each. Further information concerning this excellent 187-page booklet may be obtained from Harris A. Reynolds, Secretary, Massachusetts Forest and Park Association, 3 Joy Street, Boston, Massachusetts.

Donald Wyman

ARNOLD ARBORETUM
HARVARD UNIVERSITY

BULLETIN
OF POPULAR INFORMATION

SERIES 4. VOL. VIII DECEMBER 13, 1940 NUMBER 13

THE ATKINS INSTITUTION OF THE ARNOLD ARBORETUM, SOLEDAD, CIENFUEGOS, CUBA*

THE most distant of Harvard University's separately endowed and widely scattered units forming its botanical empire is the Atkins Institution of the Arnold Arboretum. It is situated at Soledad, about ten miles from Cienfuegos, on the south shore of Cuba, and approximately 190 miles from Havana. With the exception of the Harvard Forest at Petersham, Massachusetts, the remaining seven botanical institutions are located in Cambridge, Jamaica Plain, and Forest Hills, reasonably close to the holding body, the University itself. As the Atkins Institution, administratively a branch of the Arnold Arboretum, and like the Arboretum, based essentially on a great collection of living plants, is relatively little known to the botanical and horticultural public of the United States, it has been thought desirable to prepare this short paper summarizing its history, development, and objectives. Essentially the Atkins Institution is a botanical garden, one of the few in tropical America, and the only one not government supported. In this latter respect, being essentially a private foundation for the benefit of the public, it is unique in tropical America, and is thus in a strategic position to render important services not only to Cuba and its people, without cost to Cuba, but also to biologists in general particularly in North, Central, and South America.

Mr. Edwin F. Atkins, then a young man, left Boston for Cuba in 1869 to learn Spanish and Spanish business methods, and in 1875 he assumed full charge of the Cuban affairs of his father's firm, E. Atkins & Company. Commencing in 1882, various tracts of land were acquired in connection with business matters, and previous to the Spanish-

*See also **Barbour, T.** and **Robinson, H. M.** Forty years of Soledad. Sci. Monthly **51**: 140-146. illus. 1940.

American war in 1898, these tracts had been consolidated and organized into one of the most modern and progressively managed sugar estates in Cuba*. The Soledad Sugar Company which he organized is still a family corporation, and one that has been outstandingly successful in its field. Mr. Atkins died in 1926 at the age of 76 years, but in the meantime he had initiated and provided for the future support of a project that is proving to be of increasing value to the country in which it is located and to biology in general.

Mr. Atkins becoming interested in the possible development of better strains of sugar cane through selection and breeding, consulted with Professor George L. Goodale of Harvard University and with Professor Oakes Ames in 1899, the latter then a young man recently graduated from Harvard. These conferences resulted in an arrangement by which Professor Ames undertook to supply a certain amount of supervision and advice; Mr. Robert M. Grey, an experienced plant breeder, then in charge of the Ames collection of living orchids, was engaged for actual work at Soledad; eleven acres of land were set aside for experimental purposes; and Mr. Atkins undertook to provide the necessary financial support. Thus began the botanical development at Soledad, some 40 years ago, which in 1932 officially became the Atkins Institution of the Arnold Arboretum, Harvard University. In addition to the work on breeding new varieties of sugar cane, an early project was the introduction and acclimatization of vegetables with view to selecting and breeding varieties adapted to Cuban climatic conditions.

From the time the work was initiated at Soledad until he retired as Supervisor of the Arnold Arboretum in 1935, Professor Ames continued his interest in the project, operating it first as an adjunct to the Botanic Garden in Cambridge, later in connection with the Bussey Institution, with the advice of a special committee, and finally as an official part of the Arnold Arboretum.

Both Mr. and Mrs. Atkins were interested in plants for their aesthetic and economic values, and Mr. Grey, a very keen plantsman, encouraged and supported by them, commenced to assemble a representative collection of tropical species. Among the first accessions was an important collection of orchids and various other tropical ornamental plants transferred from the Ames greenhouses in North Easton to Soledad. Thus over a period of years the so-called "old garden" was developed, which now forms a section of the existing plantings at the Atkins Institution. Gradually through Mr. Atkins' continued interest and support the acreage was increased, the last boundary adjustments

*Atkins, E. F. Sixty years in Cuba i-xii. 1-362, illus. 1926.

PLATE VIII

1. Harvard House
2. Casa Catilina

having been made in 1938, when important adjacent tracts were added to the garden holdings by Mr. William H. Claflin, son-in-law of Mr. and Mrs. Atkins, President of the Soledad Sugar Company, and Treasurer of Harvard College. The total area of the garden is now 221.6 acres, about 40 acres less than the Arnold Arboretum holdings in Boston. Well over one half of the Soledad area has been developed on an approved planting scheme; roads, paths and bridges have been constructed, dams built across the small stream flowing through the garden to form a series of small ponds, a water tank and irrigation pipes installed, and ample propagating facilities provided. A great number of tropical plants that have been drawn from the warmer parts of both hemispheres have been established and are now thriving at Soledad.

A list of plants in cultivation at Soledad was published in 1933*. In this work 1970 species were enumerated, representing 921 genera and 165 families; the number actually planted out is now between 2500 and 3000 species. Accessions for trial have been very large in the past few years. Thus in the period 1933-35 a total of 2250 species were received for trial, while in 1937 six hundred thirty two additional ones were accessioned. These figures suffice to give some idea of how rapidly the plantings are being enriched with both native and exotic species.

Established plantings include a large palm garden, a fine cycad collection, water gardens, areas for marsh plants, a large succulent garden, a rock garden on an exposed limestone outcropping at the end of the *seboruco*, a large cactus garden, a special place for native and exotic orchids and bromeliads, a vine section, a bamboo collection, and special areas designated and now under development for representatives of the great families of tropical flowering plants. Forming as it does an "oasis" surrounded by pasture land and sugar cane fields, and including a small permanent stream, the garden site forms a natural wild life sanctuary in which bird life is particularly abundant and interesting.

Since the garden is located in a region where most of the native arborescent vegetation has been largely destroyed, it is fortunate that a considerable tract of native forest is included. This area, a rocky outcropping known as the *seboruco*, is being maintained as a characteristic representation of native lowland Cuban forest. The entire region is characterized by a relatively dry tropical climate, the annual rainfall averaging about 50 inches. Because of prolonged dry seasons, we

*Gray, R. M. and Hubbard, F. T. List of plants growing in the botanical garden of the Atkins Institution of the Arnold Arboretum at Soledad, Cienfuegos, Cuba. i-vi. 1-245. 1933.

PLATE IX

1. View across one of the ponds in the Palm Collection
2. Ceiba pentandra, Ceiba or Kapok Tree

thus have the opportunity of developing tropical plantings of those species that are more or less characteristic of those parts of Asia, Australia, Africa, Mexico, and South America which have somewhat similar climatic conditions; all of these regions have contributed extensively to the rapidly expanding plantings at Soledad. At the same time, with irrigation, it is possible to grow a great many tropical species that are adapted to regions of higher humidity and a greater or more evenly distributed annual rainfall.

To provide for the future support of the growing garden, Mr. Atkins in 1919-20 presented to Harvard University the initial payments on an endowment fund. This was increased by additional gifts from 1921 to 1925, until the total amounted to $185,141.00. This fund was designated as the Atkins Fund for Tropical Research in Economic Botany, the annual income to be expended at Soledad. Naturally with an assured annual income limited to that received from this endowment, the activities at Soledad must of necessity be restricted, and much highly desirable work must be deferred. Again as the planted areas are increased, the cost of maintenance also increases. In 1924 the Cuban unit was designated as the Harvard Biologic Institute in Cuba, and eight years later, in 1932, under the administration of Professor Ames, to simplify administration and to bring about a somewhat closer affiliation with the northern units in Massachusetts, the name was changed to the Atkins Institution of the Arnold Arboretum. Thus in effect the general field of the Arnold Arboretum in its attempt to maintain a great collection of hardy plants in the not too hospitable climate of New England, has been extended to the tropics, where, with the income from the Atkins fund, a great collection of tropical plants is now established, and is being maintained and increased.

In 1924, Mr. Atkins provided for the construction of Harvard House, as a combined headquarters building, laboratory, and living quarters, and here, since that date, many scientists have been entertained for longer or shorter periods of time. Here staff members of Harvard University, and graduate students, recipients of Harvard Fellowships for work at Soledad, and representatives of other institutions have made their home. The facilities include desk space, microscopes, glassware and other laboratory equipment, an herbarium containing a large collection of Cuban plants and representatives of species cultivated in the garden, a reference library, plant presses and driers; in fact that general type of equipment that is normally needed for biological laboratory and field work, so that visitors need take little with them other than what is needed to meet their special personal requirements. Yet from the time Harvard House was constructed, in spite of the limited

PLATE X

1. Ravenala madagascariensis. Travelers' Tree
2. Bamboo at its best

facilities available therein, an incomplete list of registrants who have lived and worked there exceeds 130 individuals, about half of whom were botanists and half zoologists.

A new dormitory, Casa Catalina, was constructed in 1938, with funds generously provided by Mrs. Atkins and Dr. Thomas Barbour, Director of Harvard University Museum and Custodian of the Atkins Institution. This is beautifully located at the crest of the ridge overlooking the garden, with a magnificent view of the Trinidad Mountains beyond. Casa Catalina now provides sleeping accomodations for at least twelve persons so that there is no reason why the facilities at present available at the Atkins Institution should not be more widely utilized.

Up to the time that Casa Catalina was constructed it was, of course, necessary to limit the number of residents or workers at Soledad, and naturally preference was given to the officers and students of Harvard University. Three Harvard University Fellowships for work at Soledad are available annually to graduate students registered at the University, and from time to time others have been made available, either from the income from the Atkins Institution endowment, or from gifts received for this purpose. In the summer of 1940, nine graduate students and one instructor worked at Soledad on various botanical and zoological problems. Representatives of other institutions and individuals interested in general biological problems, in botany, and in horticulture, are always welcome up to the limits of available space in Casa Catalina and Harvard House.

Aside from the excellent facilities now available at the Atkins Institution for biological work based on material cultivated in the garden, there are, of course, a great number of problems appertaining to the native flora and fauna of the region as a whole. The Atkins Institution forms an excellent center for biological field work on these wider problems, for many interesting regions are accessible from Soledad, including the Trinidad Mountains, with their tropical vegetation, a short distance north of the garden, which attain altitudes of between 3000 and 4000 feet; while for individuals more interested in marine zoology the brackish reaches of the Caunao, Arimao and Anaya Rivers and the salt waters of Cienfuegos Bay and the Carribean Sea are accessible. Or again, one interested in floristic studies can reach the extensively developed xerophytic vegetation characteristic of coastal areas, the mangrove swamps, and farther along the largest fresh water swamp in Cuba, the *Cienega de Zapata*, with many interesting endemic plants and animals; and to the north and east, in Santa Clara Province, between Cienfuegos and Havana, the extensive palm barrens with their characteristic plant and animal life.

In 1927, Dr. Thomas Barbour, because of his long interest in Cuban biology, his knowledge of the Spanish language and of Cuban conditions, was appointed Custodian of the Atkins Institution. Since then he has continued to direct its general program and handle its budgetary details. Because of increasing interest on the part of leading Cuban officials and citizens in the progress of the work at Soledad, on the recommendation of Dr. Barbour, the following Cuban citizens were officially appointed as Collaborators of the Atkins Institution by the President and Fellows of Harvard College in 1938: Dr. Juan T. Riog y Mesa, Brother Léon (Joseph Sylvestre Sauget y Barbier), Dr. Gonzalo Martinez Fortun y Foyo, Dr. Julián Acuña y Galé, Dr. Alberto J. Fors y Reyes, Dr. Jorge Dechapelle, and José Perez Carabia. Thus we have the sympathetic interest and support of a group of Cuban citizens who are alive to the benefits that the Atkins Institution can bestow on Cuba.

As an example of what may come through the pioneer work of the Atkins Institution, our experience with teak, first introduced in Cuba at Soledad, may be cited. This tree grows with remarkable rapidity, and its timber is highly resistant to decay and to the ravages of termites. Some of the officials of the Soledad Sugar Company, intrigued by this and by other exotic and native tree species, have established extensive forest plantings on land not particularly adapted to, or needed for, the cultivation of sugar cane, with view to providing for a future supply of durable timber for railroad ties and general construction purposes. It is evident, because of the extensive deforestation of many parts of Cuba, that in the future this problem of local timber supplies will become more and more important, and it is highly probable that other sugar estates will follow the lead of Soledad and establish similar plantings. It is very important to have a body of knowledge available regarding the cultural requirements of selected tree species, and at the same time a ready supply of fresh viable seeds.

A project that is now engaging the attention of Mr. Sturrock, the present superintendent, is the amplification of the collection of tropical plants that produce edible fruits, supplementing the large collection assembled by Mr. Grey. The objective is to have available breeding stock from widely scattered sources that may be used to produce better varieties by selection and hybridization. Mr. Sturrock is also interested in the possible utilization of tropical fruits and their products* and as was his predecessor, Mr. Grey, in the introduction and establish-

*Sturrock, D. Tropical fruits of southern Florida and Cuba and their uses. 1-131. 1940 (published by the Arnold Arboretum).

ment of supplementary food plants to augment and diversify the present not too satisfactory diet of the *guajiros*.

The garden already contains representatives of the leading tropical economic species, such as the bread fruit, jak fruit, coffee, nutmeg, clove, Manila hemp, litchi, cinnamon, etc., as well as botanical curiosities like the baobob tree, cannon ball tree, and traveler's palm (which isn't a palm at all), as well as a great collection of true palms (over 260 species) and cycads from the tropics of both hemispheres, and a great variety of economic and ornamental trees, shrubs, vines, and herbs. Some of the large groups are *Aloe*, with 90, *Agave* with 60, and *Euphorbia* (the fleshy forms) with 40 species. The Cactaceae is represented by 47 genera and about 260 species. The plantings are easily accessible through a series of roads and grass paths extending to all parts of the grounds.

In the local administration of the Atkins Institution, Mr. Robert M. Grey retired as Superintendent *Emeritus* in 1936, after a long period of efficient service, but he still resides at Soledad. He was succeeded by Mr. David Sturrock, the present Superintendent. Mr. Sturrock is ably assisted by Mr. F. G. Walsingham, a Kew Garden graduate, who is in charge of accessions and exchanges, propagation and records. Individuals wishing to avail themselves of the facilities at the Atkins Institution for a few days or longer should address the Custodian, Dr. Thomas Barbour, Museum of Comparative Zoology, Cambridge, Massachusetts. Accredited individuals planning to visit Soledad via Havana should communicate with our Havana agent, Miss Marion Henriquez, Western Union Building, Dept. 604, Havana, who will make all necessary local arrangements. Cienfuegos may be reached from Havana by train, by bus, or by airplane, or one may drive from Havana direct to Soledad over surfaced roads. Mr. Sturrock's address is Apartado 251 (Soledad) Cienfuegos, Cuba. Dormitory facilities and private rooms are available at Casa Catalina and at Harvard House, while meals may be had at Harvard House. The charges are very moderate.

Doubtless some horticulturally minded individuals visiting Cuba may wish to see this great collection of named palms and other tropical plants. Visitors are always welcome at the Atkins Institution, and we will be only too glad to advise them, and to assist in any way that we can in reference to any such proposed pilgrimage. Frankly, one of the objectives in writing this account was to make the general facilities at the Institution better known to our botanical and horticultural public with the hope that more and more individuals, visiting Cuba, may include a trip to the Atkins Institution in their itinerary.

E. D. Merrill

Illustrations are in **bold face** type.

These Bulletins will be discontinued until spring of next year.

Subscription renewals for 1941 are now due. Send the subscription price of $1.00 to the Bulletin of Popular Information, Arnold Arboretum, Jamaica Plain, Mass., at your early convenience.